

Niukluk River Salmon Counting Tower
Project Summary Report, 1998

by

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Regional Informational Report¹ No. 3A99-10

January 1999

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INTRODUCTION

The Niukluk River is a tributary of the Fish River, which empties into Golovin Bay on the north coast of Norton Sound. The Niukluk River enters the Fish River approximately ten miles above the village of White Mountain (Figure 1). The village of Council is located on the Niukluk River approximately twelve miles from its confluence with the Fish River. There is road access to the Niukluk River at the village of Council. Subsistence and sport fisheries occur on the Niukluk River.

The counting tower was successfully operated in 1995, 1996 and 1997 (Rob 1995, 1997 and 1998). A counting tower on the Niukluk River was operated for approximately three weeks in 1979 (Schaefer, 1979). The project is operated to obtain more timely and accurate escapement information required for the active management of salmon stocks throughout the season and as a means to calibrate the accuracy of aerial surveys on the other components of the Fish River system.

OBJECTIVES

1. Obtain daily and seasonal estimates of the timing and magnitude of the salmon and Dolly Varden escapement, by species, to the Niukluk River.
2. Collect and analyze age, sex and length information from beach seine sampled chum and coho salmon.

METHODS

The Niukluk River tower camp is located approximately 2 miles upstream from the confluence of the Fish and Niukluk Rivers (Figure 1). The tower camp is just upstream of Tom Gray's camp, which is locally known as Mosquito Bar. A letter of understanding from the Council Native Corporation authorizes the tower and weir operation. Permits for the weir were issued by the Alaska Department of Fish & Game (ADF&G), Habitat Division and the Alaska Department of Natural Resources, Division of Land. The camp and tower site is leased for five years on an annual renewal basis from Tom Gray.

Crewmembers began working in Nome on 29 June, 1998. The first two days were spent inventorying and purchasing equipment and supplies. The equipment and supplies were trucked to Council, with the assistance of additional ADF&G personnel from Nome. The boats were prepared for use and loaded up. Two trips were needed to ferry all of the supplies and equipment to the tower site. The site was inventoried and the camp was set up.

For 1998, the tower, flash panel and partial weir were installed directly in front of the sleeping tent, the same location as in 1996. The counting tower, partial weir and flash

panel were installed using the same methods as reported in detail in the 1995 project report (Rob, 1995). The partial weir installation proceeded smoothly and rapidly because three additional crewmembers from Nome provided assistance.

A 120 volt lighting system was installed on the tower to illuminate the flash panel during dark periods. These lights were powered by a portable generator. Beginning in early August the lights operated continuously from dusk to dawn.

The ADF&G, Commercial Fisheries Division (CFD) provided operational funding for the Niukluk River counting tower for the period beginning 29 June and ending 1 September. In previous years ADF&G, Sport Fish Division provided funding for the month from 16 August through 15 September. Counting began at 0000 hours on 4 July 1998. The crew counted 18 half-hour counts in three six hour shifts each day except Tuesdays and Wednesdays. The first shift ran from 0000 hours to 0530 hours, the second ran from 1200 hours to 1730 hours and the third shift ran from 1800 hours to 2330 hours. On Tuesdays the half-hour counts ran for 24 hours in three eight hour shifts. Wednesdays were the day off. To reduce the risk of missing the peak hours of the coho salmon escapement, the ADF&G, Sport Fish Division requested that the schedule be modified during the first two weeks of August to count from 0000 through 0500 hours on the day off.

The counts for each half hour shift were doubled to produce the reported hourly counts for each species. Each day the reported hourly counts were added to produce a daily subtotal. Every day, the daily and cumulative subtotals for each species were relayed to the Nome office by radio.

The expanded counts for this report were calculated using the following methods. The 18 hour counts for Wednesdays (the day off) were estimated by adding the counts of each hour of the day before (Tuesdays) to the counts of each hour of the day following (Thursdays) and dividing the result by two, giving expanded hourly counts for 18 hours of the day off. Escapement during the 6 hours not normally counted was estimated using data observed during the 24 hour count days. For each 24 hour count day, the ratio of the count from 0600 hours to 1200 hours to the count during the normal 18 hour counting period was computed. The 18 hour count for the three days before and after each 24 hour count day was multiplied by the ratio to estimate escapement during the 6 hours not normally counted. This 6 hour estimate was added to the 18 hour count for each day. This was done for all species counted.

The expanded counts for the hours missed, during the days off or while the crew was beach seining, were estimated as follows. For a day the normal 18 hour count was missed, the count for each missing hour was calculated by adding the count of the hour of the day before the missed period to the counts of the hour of the day following the missed period and dividing the result by two.

On most Wednesdays the crew went to White Mountain to pick up groceries, supplies and mail that were sent from Nome via air. Groceries, supplies and mail were also periodically brought to Council by Nome staff.

Beginning 4 July, the crew began beach seining and sampling chum salmon for age, length and sex data. If 40 or less chum salmon were available, then all were sampled. If more than 40 chum salmon were available, then 40 were sampled. Coho salmon were not sampled this year because the large numbers of pink salmon made any beach seining difficult during July and early August and high water ended the counting season early this year.

RESULTS

Table 1 shows the expanded daily and cumulative totals for each species.

The reported total hourly counts were: 36,540 chum salmon, 1,232,340 pink salmon, 192 king salmon, 602 coho salmon, and 1,692 Dolly Varden (Tables 7-11). The expanded counts were: 45,587 chum salmon, 1,624,436 pink salmon, 258 king salmon, 839 coho salmon, and 2,419 Dolly Varden (Tables 2-6). Figure 2 shows a graph of the daily cumulative expanded passage of all salmonid species counted, except pink salmon. Figures 3-12 show graphs of the expanded daily totals and the cumulative daily totals for each species.

All species, except coho salmon, were observed on 4 July, the first day of counting. Coho salmon were first observed on 20 July (Table 1). The daily peak count of 4,147 chum salmon occurred on 11 July, the daily peak count of 201,956 pink salmon occurred on 21 July, the daily peak count of 42 king salmon occurred on 4 and 6 July, the daily peak count of 176 coho salmon occurred on 13 August (the last day of counting), the daily peak count of 109 Dolly Varden occurred on 1 August (Table 1).

Most chum salmon returned during the first three weeks of counting when 89% passed the tower (Table 1 and Figures 3 and 4). Most pink salmon returned during the first three weeks of counting when 91% passed the tower (Table 1 and Figures 5 and 6). All king salmon returned during the first three weeks of counting (Table 1 and Figures 7 and 8). Most coho salmon returned during the last two weeks of counting when 83% passed the tower (Table 1 and Figures 9 and 10). Dolly Varden returned in pulses with peaks on 5, 18, and 23 July and on 1 and 10 August (Table 1 and Figures 11 and 12).

All species counted exhibited a diurnal pattern of migration past the counting tower. The greatest hourly chum salmon migration occurred during the hour from 2300 to 0000 hours, when 9.5% passed the tower. During the nine hour period from 1800 through 0200 hours, 68% of the chum salmon passed the tower (Table 2 and Figure 13). The greatest hourly pink salmon migration occurred during the hour from 2300 to 0000 hours and during the hour from 0000 to 0100 hours, when 10% passed the tower. During the

nine hour period from 1800 through 0200 hours, 69% of the pink salmon passed the tower (Table 3 and Figure 14). The greatest hourly king salmon migration occurred during the hour from 0100 to 0200, when 8.9% passed the tower. During the five hour period from 1500 through 1900 hours 30% of the king salmon passed the tower and during the five hour period from 2100 through 0100 hours 29% of the king salmon passed the tower. There was a net downstream migration of king salmon during the hour from 1200 through 1300 hours (Table 4 and Figure 15). The greatest hourly coho salmon migration occurred during the hour from 1400 through 1500 hours, when 14.1% passed the tower. During the three hour period from 1400 through 1600 hours 28% of the coho salmon passed the tower. During the six hour period from 2200 through 0300 hours, 37% of the coho salmon passed the tower (Table 5 and Figure 16). The greatest hourly Dolly Varden migration occurred during the hour from 2300 to midnight, when 8.4% passed the tower. During the eleven hour period from 1900 through 0500 hours, 58% of the Dolly Varden passed the tower (Table 6 and Figure 17).

An aerial survey of the entire Niukluk River counted 2,556 chum salmon on 21 July, 1998. The total season expanded tower count of chum salmon was 45,587. The aerial survey counted 6% of the total season expanded tower count of chum salmon. The aerial survey counted 2,265 chum salmon above the counting tower on 21 July, when the cumulative tower count of chum salmon was 37,927. The aerial survey counted 6% of the cumulative tower count on 21 July (Table 1).

An aerial survey of the entire Niukluk River counted 205,110 pink salmon on 21 July, 1998. The total season expanded tower count of pink salmon was 1,624,436. The aerial survey counted 13% of the total season expanded tower count of pink salmon. The aerial survey counted 176,000 pink salmon above the counting tower on 21 July, when the cumulative tower count of pink salmon was 1,292,526. The aerial survey counted 14% of the cumulative tower count on 21 July (Table 1).

Readable scales were collected from a total of 138 chum salmon. Beach seine samples were collected from 4 through 20 July. The age composition of the beach seine sample was 1.4% age-0.2, 60.1% age-0.3, 34.8% age-0.4, and 3.6% age-0.5. Female chum salmon were 43.5% and male chum salmon were 56.5% of the sample. For all age-sex categories younger fish were smaller and males were larger than females (Tables 12).

Climatological and stream observations are shown in Table 13.

DISCUSSION

A counting tower project was operated on the Niukluk River in 1979. That project collected incomplete data from 9 July to 27 July (Schaefer, 1979).

The Niukluk River counting tower project was operated as a cooperative project between ADF&G and the Kawerak Corporation in 1994. Rains throughout the summer kept water

levels high and an early August flood washed out the partial weir so that no useable data was collected. However, much was accomplished in 1994, the camp infrastructure of tent platforms was built and an appreciation of the difficulties associated with operating on the Niukluk River was gained (Charles Lean, ADF&G, CF Division, personal communication). In 1995 the Niukluk River counting tower operated successfully for the first time. Steadily decreasing water levels for most of the season and improved partial weir equipment were the primary reasons for this success (Rob, 1996). In 1996 the counting tower was operated successfully again, except for the period from 25 July through 3 August when the partial weir was washed out (Rob 1997). In 1997 the counting tower was operated successfully again, except for the five day period from 30 August through 4 September when high water prevented counting.

In 1998, counting began at 0000 hours on 4 July. The estimated passage of 883 chum, 931 pink salmon, 42 king salmon and 74 Dolly Varden by midnight on 4 July indicates that passage began several days earlier (Tables 2-4 and 6). Coho salmon passage began well after the tower began operating (Table 5).

The run-timing of chum salmon in 1998 was similar to the 1995-1997 average run-timing. The magnitude of the escapement was about 61% of the 1995-1997 average escapement. The 1995-1997 average cumulative escapement on 3 July was 8,186 chum salmon, which indicates that a significant portion of the early escapement was missed this year (Figures 18 and 23). The run-timing of the even year pink salmon escapement in 1998 was about two days later than the 1996 escapement and the magnitude of the 1998 escapement was about 40% greater than the 1996 even year escapement (Figures 19 and 24). The run-timing of the king salmon escapement in 1998 was similar to the 1995-1997 average run-timing. The king salmon escapement in 1998 was more than double the 1995 escapement and similar to the 1996 and 1997 escapements (Figures 20 and 25). The king salmon escapement could have been much larger than estimated, more than 40% of the 1997 king escapement passed the tower prior to the start of counting this year (Rob 1998). The run-timing of the coho salmon escapement in 1998 was similar to the 1995-1997 average run-timing during the first half of the escapement, but is not comparable for the second half due to early termination of the project in 1998. Through 13 August, the magnitude of the 1998 coho salmon escapement was smaller than the 1995 and 1996 escapements and similar to the 1997 escapement (Figures 21 and 26). The run-timing of the 1998 Dolly Varden escapement through 13 August was similar to the 1996-1997 average run-timing. Through 13 August, the magnitude of the 1998 Dolly Varden escapement was between the 1996 and 1997 levels (Figures 22 and 27).

Beach seine sampling was difficult because of the high water during much of the summer and the large numbers of pink salmon present this year.

Difficulties encountered the past three years while counting from the tower included species identification problems at the far end of the flash panel during times of poor visibility, severe glare from sunlight in the evening, spawning fish covering portions of the flash panel with gravel, and occasional wind turbulence that made species

identification problematic along the length of the flash panel. Counting accuracy decreases when the rate of passage increases and this probably occurred from 10 July through 23 July in 1998 when there were 79 hours for which the reported count of pink salmon exceeded 6,000 fish per hour, the peak reported hourly count of pink salmon was 27,468 (Table 8).

Counting was suspended when the weir pickets were removed on 13 August because of high muddy water (Table 21). High water and large trees knocked over a portion of the weir on 20 August. The high water continued through September and removing the weir bipods and stringers was extremely difficult. A small section of weir was **not** retrieved.

ACKNOWLEDGEMENTS

Carl "Bones" Brown was the crew leader for the entire season. Jenny Hamberger worked as a crew member beginning 24 July. Enid Brown was a Norton Sound Economic Development Corporation (NSEDC) intern until early-August and was replaced by Gus Kasnoc who finished the season. NSEDC hired and provided funding for **the** interns. Gary Knuepfer of ADF&G provided assistance and expertise as needed throughout the season. A draft of this report was reviewed by Larry Buklis.

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Table 1. Expanded daily and cumulative migration of all salmonid species past the Niukluk River counting tower, Norton Sound, 1998.

Date	Daily chum salmon	Cumulative chum salmon	Daily pink salmon	Cumulative pink salmon	Daily king salmon	Cumulative king salmon	Daily coho salmon	Cumulative coho salmon	Daily Dolly Varden	Cumulative Dolly Varden
4-Jul	883	883	931	931	42	42	0	0	74	74
5-Jul	1,494	2,377	2,154	3,086	26	68	0	0	83	157
6-Jul	2,322	4,699	5,456	8,541	42	109	0	0	76	233
7-Jul	3,170	7,869	24,622	33,163	26	135	0	0	24	257
8-Jul	2,055	9,924	21,526	54,689	16	151	0	0	21	278
9-Jul	940	10,864	18,430	73,120	5	156	0	0	17	296
10-Jul	2,053	12,916	65,144	138,264	26	182	0	0	35	331
11-Jul	4,147	17,063	97,225	235,488	8	190	0	0	13	344
12-Jul	2,536	19,599	75,556	311,045	19	209	0	0	8	352
13-Jul	3,299	22,898	114,399	425,444	11	219	0	0	19	371
14-Jul	1,590	24,488	80,866	506,310	8	227	0	0	32	403
15-Jul	1,986	26,474	96,999	603,308	7	234	0	0	60	463
16-Jul	2,382	28,856	113,131	716,439	5	239	0	0	88	551
17-Jul	2,779	31,634	162,851	879,290	8	247	0	0	45	596
18-Jul	1,574	33,208	91,054	970,344	0	247	0	0	106	702
19-Jul	751	33,959	43,313	1,013,657	10	257	0	0	47	748
20-Jul	1,096	35,055	76,914	1,090,570	-2	255	4	4	37	785
21-Jul	2,872	37,927	201,956	1,292,526	2	257	8	12	32	817
22-Jul	1,686	39,613	129,753	1,422,279	1	258	12	24	62	879
23-Jul	500	40,114	57,550	1,479,829	0	258	16	40	91	970
24-Jul	591	40,705	-9,675	1,470,153	0	258	20	60	71	1,041
25-Jul	348	41,053	10,254	1,480,407	0	258	12	72	39	1,080
26-Jul	552	41,605	13,541	1,493,948	0	258	10	82	50	1,130
27-Jul	688	42,293	15,974	1,509,923	0	258	14	96	45	1,175
28-Jul	516	42,809	14,156	1,524,079	0	258	22	118	80	1,255
29-Jul	428	43,237	14,311	1,538,389	0	258	16	134	84	1,340
30-Jul	340	43,576	14,466	1,552,855	0	258	10	144	89	1,428
31-Jul	436	44,012	15,195	1,568,050	0	258	16	160	101	1,529
1-Aug	272	44,284	11,387	1,579,437	0	258	23	183	109	1,638
2-Aug	130	44,414	3,504	1,582,940	0	258	12	195	63	1,701
3-Aug	51	44,465	4,273	1,587,213	0	258	37	232	72	1,773
4-Aug	100	44,565	3,982	1,591,195	0	258	30	262	50	1,823
5-Aug	82	44,647	3,730	1,594,925	0	258	33	295	47	1,870
6-Aug	32	44,679	3,585	1,598,510	0	258	42	337	44	1,913
7-Aug	213	44,892	5,707	1,604,218	0	258	48	385	66	1,979
8-Aug	260	45,152	5,528	1,609,746	0	258	30	415	55	2,034
9-Aug	217	45,368	4,414	1,614,159	0	258	19	434	73	2,107
10-Aug	170	45,539	3,983	1,618,143	0	258	34	468	102	2,209
11-Aug	26	45,565	2,392	1,620,535	0	258	72	540	70	2,279
12-Aug	4	45,569	2,270	1,622,805	0	258	124	663	88	2,367
13-Aug	17	45,587	1,631	1,624,436	0	258	176	839	53	2,419

Table 2. Expanded daily hourly chum salmon migration past the Niukluk River counting tower, Norton Sound, 1998.

Date	Outline areas indicate hours not counted. Numbers in outlined areas indicate estimated passage.																							% of Total
	0000	0100	0200	0300	0400	0500	0600-1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	Total				
4-Jul	38	36	60	10	8	4	17	10	0	12	50	114	36	140	126	74	50	66	32	883	1.9%			
5-Jul	108	72	36	10	0	-2	28	-8	-8	0	2	16	56	108	120	178	394	284	100	1,494	3.3%			
6-Jul	52	32	120	66	82	38	44	-2	12	78	54	16	42	372	220	142	372	448	134	2,322	5.1%			
7-Jul	222	454	248	328	388	130	60	4	2	-2	0	6	2	58	178	164	212	322	394	3,170	7.0%			
8-Jul	139	243	144	169	201	69	39	2	4	13	85	20	15	44	106	99	168	181	314	2,055	4.5%			
9-Jul	56	32	40	10	14	8	18	0	6	28	170	34	28	30	34	34	124	40	234	940	2.1%			
10-Jul	278	270	192	182	122	102	39	-2	6	28	34	152	162	84	24	8	78	56	238	2,053	4.5%			
11-Jul	222	556	268	178	378	190	449	0	2	0	10	16	14	36	316	398	378	344	392	4,147	9.1%			
12-Jul	500	112	308	154	162	126	274	2	6	12	8	2	18	68	116	164	130	124	250	2,536	5.6%			
13-Jul	334	154	242	164	202	262	357	0	0	2	6	48	70	148	196	356	270	228	260	3,299	7.2%			
14-Jul	148	112	56	30	58	80	172	20	32	36	78	98	32	62	16	206	104	98	152	1,590	3.5%			
15-Jul	149	133	85	39	76	124	215	5	4	14	51	68	53	119	168	181	80	171	251	1,986	4.4%			
16-Jul	150	154	114	48	94	168	258	-10	-24	-8	24	38	74	176	320	156	56	244	350	2,382	5.2%			
17-Jul	232	278	160	218	186	290	301	-18	-2	-2	36	24	14	180	226	170	190	204	92	2,779	6.1%			
18-Jul	234	206	188	46	64	106	158	6	22	40	26	34	68	46	78	38	76	58	80	1,574	3.5%			
19-Jul	130	116	104	8	16	64	75	-8	0	10	4	46	8	18	16	8	20	62	54	751	1.6%			
20-Jul	114	52	40	18	36	50	110	-2	-2	-2	58	58	42	58	80	74	98	112	102	1,096	2.4%			
21-Jul	204	196	206	66	96	188	288	12	18	76	112	56	218	184	132	138	238	252	192	2,872	6.3%			
22-Jul	142	144	109	33	50	98	169	16	13	48	78	39	120	108	85	73	125	128	108	1,686	3.7%			
23-Jul	80	92	12	0	4	8	50	20	8	20	44	22	22	32	38	8	12	4	24	500	1.1%			
24-Jul	2	8	-2	12	0	2	59	-26	2	0	18	18	60	102	54	74	60	58	90	591	1.3%			
25-Jul	38	4	16	4	8	8	36	-14	0	-6	4	20	28	8	56	18	24	50	46	348	0.8%			
26-Jul	44	24	14	14	6	46	58	-2	0	12	2	16	38	44	28	8	72	66	62	552	1.2%			
27-Jul	104	44	12	12	0	10	72	2	10	10	14	50	40	98	46	68	32	24	40	688	1.5%			
28-Jul	38	32	10	6	6	8	54	-2	-2	4	18	48	48	56	36	64	60	34	516	1.1%				
29-Jul	30	21	8	7	4	5	45	0	0	1	5	17	36	42	51	26	47	47	36	428	0.9%			
30-Jul	22	10	6	8	2	2	36	2	2	4	6	16	24	36	46	16	30	34	38	340	0.7%			
31-Jul	46	30	0	4	0	12	46	-2	2	6	6	8	32	22	12	18	68	58	68	436	1.0%			
1-Aug	38	12	4	10	2	0	16	-2	4	10	6	34	24	24	22	18	12	2	36	272	0.6%			
2-Aug	18	12	-2	2	2	0	8	-4	-4	8	20	12	4	10	6	10	-2	10	20	130	0.3%			
3-Aug	0	0	0	4	2	0	3	0	-4	-6	6	-4	-2	8	10	0	10	6	18	51	0.1%			
4-Aug	0	0	0	4	2	0	6	2	-4	0	8	6	6	0	8	26	6	20	10	100	0.2%			
5-Aug	4	4	4	10	0	0	5	3	-2	0	4	4	2	2	6	14	2	14	6	82	0.2%			
6-Aug	0	4	0	2	2	0	2	4	0	0	0	2	-2	4	4	2	-2	8	2	32	0.1%			
7-Aug	2	4	10	2	2	0	13	0	0	2	4	4	12	32	28	24	20	8	44	213	0.5%			
8-Aug	24	30	24	12	6	10	80	0	2	4	8	2	4	-6	0	10	0	24	26	260	0.6%			
9-Aug	12	18	8	18	6	0	67	4	0	-2	3	-2	2	6	0	8	12	30	28	217	0.5%			
10-Aug	32	18	8	8	10	4	52	0	-2	4	2	-2	2	2	2	4	14	10	2	170	0.4%			
11-Aug	-2	10	-6	2	12	8	8	2	2	0	0	-4	-2	2	-4	2	0	0	-4	26	0.1%			
12-Aug	0	2	0	2	2	0	1	2	2	1	0	-2	-2	2	-4	2	0	0	-4	4	0.0%			
13-Aug	0	2	0	2	2	0	5	2	2	2	0	0	0	0	0	0	0	0	0	17	0.0%			
Total	3,984	3,733	2,846	1,922	2,313	2,220	3,792	18	109	451	1,049	1,120	1,448	2,557	3,022	3,053	3,644	3,955	4,351	45,587				
	8.7%	8.2%	6.2%	4.2%	5.1%	4.9%	8.3%	0.0%	0.2%	1.0%	2.3%	2.5%	3.2%	5.6%	6.6%	6.7%	8.0%	8.7%	9.5%	1				

a 3. Expanded daily hourly pink salmon migration past the Niukluk River counting station, Norton Sound, 1998.

Outlined areas indicate hours not counted. Numbers in outlined areas indicate estimated passage.

Date	0000	0100	0200	0300	0400	0500	0600-1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	Total	% of Total
4-Jul	32	30	38	20	10	42	19	0	0	14	18	128	88	140	126	74	50	86	16	931	0.1%
5-Jul	54	54	136	118	20	4	44	-8	-2	2	2	124	66	186	212	242	424	254	222	2,154	0.1%
6-Jul	116	182	174	196	266	150	113	-5	62	434	164	106	70	348	314	294	992	932	548	5,456	0.3%
7-Jul	610	1,318	1,254	1,334	2,746	1,532	508	-2	0	6	6	74	78	248	1,712	2,746	2,754	3,978	3,720	24,622	1.5%
8-Jul	722	1,155	928	825	1,464	869	444	5	57	221	423	206	139	373	1,104	1,966	3,286	2,997	4,342	21,526	1.3%
9-Jul	834	992	602	316	182	206	380	12	114	436	840	338	200	498	496	1,186	3,818	2,016	4,964	18,430	1.1%
10-Jul	8,082	13,928	7,710	7,120	2,630	3,866	1,344	-16	58	606	480	1,950	2,818	2,628	1,192	1,126	1,954	2,786	4,882	65,144	4.0%
11-Jul	3,562	10,110	5,438	4,294	6,332	3,830	11,201	-34	-10	-42	52	68	124	428	9,418	10,122	11,362	10,528	10,442	97,225	6.0%
12-Jul	9,542	3,116	5,432	3,348	3,884	4,094	8,704	-12	0	20	286	38	660	1,674	2,812	8,216	6,278	6,810	10,654	75,556	4.7%
13-Jul	14,262	8,536	6,380	3,040	3,400	7,908	13,179	62	-74	-4	106	1,344	1,596	1,856	4,650	15,142	11,272	10,090	11,654	114,399	7.0%
14-Jul	10,862	7,526	2,658	1,298	1,300	4,986	9,316	442	814	1,258	2,240	5,282	1,674	3,200	1,104	7,592	4,246	6,916	8,152	80,866	5.0%
15-Jul	9,621	7,258	3,157	1,447	1,682	4,972	11,175	-220	-324	467	1,221	3,113	1,930	5,597	6,493	8,274	5,232	9,093	16,811	96,999	6.0%
16-Jul	8,380	6,990	3,656	1,596	2,064	4,958	13,033	-882	-1,462	-324	202	944	2,186	7,994	11,882	8,956	6,218	11,270	25,470	113,131	7.0%
17-Jul	27,468	15,150	20,314	6,546	8,894	8,696	18,761	-1,322	-870	-948	-294	-162	112	6,872	11,672	11,764	13,000	10,532	6,666	162,851	10.0%
18-Jul	14,432	9,404	6,729	1,156	1,000	4,768	10,872	330	832	2,930	2,476	2,618	3,598	3,394	4,110	4,500	5,064	6,248	6,602	91,054	5.6%
19-Jul	8,466	6,794	2,342	252	332	1,564	5,172	-436	210	534	654	2,125	2,468	800	968	1,470	2,112	4,458	3,028	43,313	2.7%
20-Jul	4,694	3,380	1,052	352	306	1,336	9,184	-246	-208	-118	6,100	1,632	2,720	2,924	6,924	7,742	8,568	10,442	10,130	76,914	4.7%
21-Jul	11,282	12,510	6,756	1,838	2,204	5,862	24,114	134	1,816	9,868	11,546	5,844	20,950	17,778	17,980	11,022	14,310	16,484	9,658	201,956	12.4%
22-Jul	9,623	8,334	3,534	945	1,118	4,262	15,493	2,013	2,783	6,429	8,606	5,378	13,147	10,745	10,332	6,548	7,524	8,248	4,691	129,753	8.0%
23-Jul	7,964	4,158	312	52	32	2,662	6,872	3,892	3,750	2,990	5,666	4,912	5,344	3,712	2,684	2,074	738	12	-276	57,550	3.5%
24-Jul	-410	-610	-250	2	-188	-1,378	-1,155	-5,898	-4,252	-2,790	-1,688	-606	130	1,122	826	1,046	1,678	1,652	3,094	-9,675	-0.6%
25-Jul	272	-74	66	70	114	266	452	8	2	218	152	428	1,052	850	1,258	774	908	1,268	2,170	10,254	0.6%
26-Jul	1,242	1,162	372	178	234	738	597	-268	-346	264	248	258	850	1,256	968	414	1,536	1,888	1,950	13,541	0.8%
27-Jul	3,102	1,472	252	118	50	386	704	-28	48	92	108	500	508	1,290	2,100	1,266	1,132	1,128	1,746	15,974	1.0%
28-Jul	748	756	122	38	14	176	624	116	28	64	182	446	578	1,422	1,420	1,368	1,922	2,302	1,830	14,156	0.9%
29-Jul	1,042	533	98	36	18	181	631	131	77	137	189	371	549	1,522	1,659	1,634	1,727	2,046	1,730	14,311	0.9%
30-Jul	1,336	310	74	34	22	186	638	146	126	210	196	296	520	1,622	1,898	1,900	1,532	1,790	1,630	14,466	0.9%
31-Jul	1,826	928	100	64	64	286	670	106	196	166	159	224	396	958	1,386	1,486	1,802	2,256	2,122	15,195	0.9%
1-Aug	1,482	194	86	52	56	26	3,243	4	90	64	122	486	506	854	756	1,070	672	674	950	11,387	0.7%
2-Aug	210	176	68	14	-8	12	998	108	232	10	226	284	254	256	-74	120	210	174	234	3,504	0.2%
3-Aug	282	18	2	24	22	28	1,217	222	342	160	228	174	304	68	100	212	356	332	182	4,273	0.3%
4-Aug	24	30	32	28	22	82	1,134	218	250	214	220	144	156	108	250	296	284	208	282	3,982	0.2%
5-Aug	28	37	36	24	28	53	1,062	200	208	226	254	172	211	98	215	257	197	166	258	3,730	0.2%
6-Aug	32	44	40	44	56	54	1,021	182	166	238	288	200	266	88	180	218	110	124	234	3,585	0.2%
7-Aug	60	82	12	20	34	24	1,625	150	120	256	238	282	318	228	406	378	552	470	452	5,707	0.4%
8-Aug	204	74	82	44	26	60	2,214	178	270	244	342	398	380	122	170	116	182	178	244	5,528	0.3%
9-Aug	80	34	30	52	12	10	1,768	298	354	326	308	292	214	44	88	118	150	68	168	4,414	0.3%
10-Aug	42	32	32	18	12	-10	1,505	184	210	174	152	178	200	234	206	224	196	174	130	3,983	0.2%
11-Aug	98	200	68	66	66	34	958	136	116	120	126	96	32	46	38	30	-2	60	104	2,392	0.1%
12-Aug	108	114	84	68	100	60	909	136	116	92	109	66	32	46	38	30	-2	60	104	2,270	0.1%
13-Aug	108	114	84	68	100	60	653	136	116	64	92	36	End of counting season						1,631	0.1%	
Total	162,524	126,551	80,083	37,155	40,720	67,901	181,484	172	6,015	25,328	43,045	40,787	67,424	83,629	110,073	124,013	124,344	141,198	161,990	1,624,436	
	10.0%	7.8%	4.9%	2.3%	2.5%	4.2%	11.2%	0.0%	0.4%	1.6%	2.6%	2.5%	4.2%	5.1%	6.8%	7.6%	7.7%	8.7%	10.0%		

Table 4. Expanded daily hourly king salmon migration past the Niukluk River counting tower, Norton Sound, 1998.

Date	Estimated Passage																Total	% of Total			
	0000	0100	0200	0300	0400	0500	0600-1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300		
4-Jul	0	0	0	0	0	0	10	0	0	2	0	0	0	14	12	0	4	0	0	42	16.1%
5-Jul	8	0	0	0	0	4	6	0	0	0	0	0	0	4	0	0	2	2	0	26	10.1%
6-Jul	2	6	2	4	0	2	10	0	2	0	4	4	4	-2	0	0	0	2	2	42	16.1%
7-Jul	0	2	0	4	0	2	6	0	0	0	0	0	0	0	4	0	2	2	4	26	10.1%
8-Jul	0	1	0	2	0	1	4	0	0	0	2	0	0	0	2	0	1	1	2	16	6.0%
9-Jul	0	0	0	0	0	0	1	0	0	0	4	0	0	0	0	0	0	0	0	5	2.0%
10-Jul	0	10	0	0	0	2	0	6	0	-2	0	6	0	2	0	2	0	0	0	26	10.1%
11-Jul	2	0	2	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	8	3.1%
12-Jul	0	0	0	2	2	4	5	0	2	0	0	0	0	2	0	0	2	0	0	19	7.2%
13-Jul	2	-2	0	0	4	0	3	0	0	2	0	0	0	0	0	0	2	0	0	11	4.1%
14-Jul	2	0	-2	0	2	0	2	0	0	0	-2	4	0	0	0	2	0	0	0	8	3.1%
15-Jul	1	0	-1	0	1	0	2	0	0	0	-1	2	1	0	0	1	0	1	0	7	2.6%
16-Jul	0	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	0	2	0	5	2.1%
17-Jul	0	0	2	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0	2	8	3.1%
18-Jul	0	0	0	0	0	0	0	-2	0	0	0	0	0	2	0	0	0	0	0	0	0.0%
19-Jul	0	4	0	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	10	3.9%
20-Jul	0	0	0	0	0	-2	0	0	-2	0	0	0	0	0	0	0	0	2	0	-2	-0.8%
21-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0.8%
22-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0.4%
23-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
24-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
25-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
26-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
27-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
28-Jul	0	0	0	0	0	-2	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0.0%
29-Jul	0	0	0	0	0	-1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0.0%
30-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
31-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
1-Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
2-Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
3-Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
4-Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
5-Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
6-Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
7-Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
8-Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
9-Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
10-Aug	0	2	0	0	0	0	0	-2	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
11-Aug	0	0	0	-2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
12-Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
13-Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
	End of counting season																				
T _r	17	23	3	12	15	10	58	-2	0	6	13	5.0%	5.0%	3.5%	8.1%	8.5%	1.2%	5.0%	4.6%	3.9%	25
	6.6%	8.9%	1.2%	4.6%	5.8%	3.9%	22.6%	-0.8%	0.0%												

5. Expanded daily hourly coho salmon migration past the Niukluk River counter, Norton Sound, 1998.

Outlined areas indicate hours not counted. Numbers in outlined areas indicate estimated passage.

Date	0000	0100	0200	0300	0400	0500	0600-1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	Total	% of Total	
4-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
5-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
6-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
7-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
8-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
9-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
10-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
11-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
12-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
13-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
14-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
15-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
16-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
17-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
18-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
19-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
20-Jul	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2	0	0	0	0	0	4	0.5%
21-Jul	0	0	0	0	0	0	0	4	0	0	0	0	0	2	2	0	0	0	0	0	8	1.0%
22-Jul	1	0	0	3	0	0	6	0	0	0	0	0	1	1	0	0	0	0	0	0	12	1.4%
23-Jul	2	0	0	6	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	16	1.9%
24-Jul	0	0	0	2	0	0	10	0	0	2	0	0	2	0	0	4	0	0	0	0	20	2.4%
25-Jul	0	0	0	2	0	0	0	0	2	2	0	2	0	0	0	0	0	0	0	0	12	1.4%
26-Jul	0	0	8	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	1.2%
27-Jul	0	2	6	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	14	1.7%
28-Jul	2	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	2	8	6	22	2.6%	
29-Jul	1	0	0	0	0	0	0	0	0	0	1	1	0	1	0	4	5	3	16	1.9%		
30-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	6	2	0	0	10	1.2%	
31-Jul	4	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	4	2	16	1.9%	
1-Aug	2	4	2	0	0	0	3	0	0	0	0	0	0	4	4	2	0	0	2	23	2.7%	
2-Aug	2	2	0	0	2	0	2	2	0	0	0	0	0	0	0	2	0	0	0	12	1.4%	
3-Aug	2	2	0	0	0	0	5	0	0	0	0	0	2	2	6	8	2	8	0	37	4.4%	
4-Aug	0	0	0	0	0	0	4	2	0	0	2	2	0	-2	2	4	2	0	14	30	3.6%	
5-Aug	2	0	0	2	2	0	4	2	0	0	2	1	3	-1	2	2	1	2	9	33	4.0%	
6-Aug	4	2	2	4	2	2	6	2	0	0	2	0	6	0	2	0	0	4	4	42	4.9%	
7-Aug	0	0	2	2	0	0	6	0	0	4	2	2	6	0	4	12	2	4	2	48	5.8%	
8-Aug	4	0	2	0	0	0	2	0	0	2	0	2	0	8	0	2	2	2	4	30	3.5%	
9-Aug	0	0	0	0	0	0	1	0	4	0	0	0	0	2	0	2	4	0	6	19	2.3%	
10-Aug	2	2	6	0	0	0	2	2	0	0	0	2	2	0	2	0	0	2	10	34	4.0%	
11-Aug	8	14	2	8	14	0	4	0	2	0	0	4	0	2	0	0	0	8	6	72	8.6%	
12-Aug	4	10	4	6	4	2	7	0	2	36	20	13	0	2	0	0	0	8	6	124	14.8%	
13-Aug	4	10	4	6	4	2	10	0	2	72	40	22	End of counting season						176	20.9%		
Total	44	50	38	43	28	6	85	10	14	118	70	49	29	24	31	40	27	59	74	830		
	5.2%	6.0%	4.5%	5.1%	3.3%	0.7%	10.2%	1.2%	1.7%	14.1%	8.3%	5.8%	3.5%	2.9%	3.7%	4.8%	3.2%	7.0%	8.8%			

Table 6. Expanded daily hourly Dolly Varden migration past the Niukluk River counting tower, Norton Sound, 1998.

Date	Outlined areas indicate hours not counted. Numbers in outlined areas indicate estimated passage.																			% of Total		
	0000	0100	0200	0300	0400	0500	0600-1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300			
4-Jul	10	26	4	16	0	2	6	-2	0	2	2	2	0	6	0	0	0	0	0	74	3.1%	
5-Jul	4	6	8	12	16	10	7	0	2	4	0	2	4	0	0	2	4	2	0	83	3.4%	
6-Jul	22	8	6	4	6	8	6	0	0	0	0	0	0	0	4	4	6	2	76	3.2%		
7-Jul	2	2	4	2	0	2	2	0	0	0	0	0	0	0	4	2	0	4	0	24	1.0%	
8-Jul	1	2	2	1	0	1	2	0	2	0	2	0	0	0	2	2	2	2	0	21	0.9%	
9-Jul	0	2	0	0	0	0	1	0	4	0	4	0	0	0	0	2	4	0	0	17	0.7%	
10-Jul	0	2	0	0	0	2	0	3	2	2	0	0	0	6	2	10	2	2	2	0	35	1.4%
11-Jul	0	0	0	0	0	0	3	2	0	2	0	0	0	2	2	2	0	0	0	13	0.6%	
12-Jul	0	0	0	0	0	0	2	0	0	2	2	0	0	0	0	2	0	0	0	8	0.3%	
13-Jul	0	2	0	2	0	0	5	0	0	0	0	0	6	0	0	2	2	0	0	19	0.8%	
14-Jul	0	0	0	4	0	0	8	0	4	0	2	0	0	0	0	0	2	12	0	32	1.3%	
15-Jul	3	6	2	11	6	1	15	0	2	0	2	0	0	0	2	0	0	3	6	1	60	2.5%
16-Jul	6	12	4	18	12	2	22	0	0	0	2	0	0	4	0	0	0	4	0	2	88	3.6%
17-Jul	0	0	0	8	16	2	11	2	0	0	0	0	0	4	0	0	0	0	0	2	45	1.9%
18-Jul	2	4	2	12	20	46	20	0	0	0	2	0	0	0	0	0	0	0	0	-2	106	4.4%
19-Jul	6	12	6	0	6	6	9	0	0	0	0	0	0	0	0	0	0	2	0	0	47	1.9%
20-Jul	0	0	6	2	8	6	7	2	0	0	0	2	0	0	0	2	0	0	2	0	37	1.5%
21-Jul	0	0	0	8	6	12	6	0	0	0	0	0	0	0	0	0	0	0	0	0	32	1.3%
22-Jul	0	0	1	4	3	6	12	2	1	2	1	5	9	5	6	4	0	0	1	62	2.5%	
23-Jul	0	0	2	0	0	0	17	4	2	4	2	10	18	10	12	8	0	0	0	2	91	3.8%
24-Jul	2	0	0	0	0	0	6	13	2	0	2	4	6	10	0	4	6	10	4	2	71	3.0%
25-Jul	0	0	0	0	0	0	3	0	0	4	10	4	4	2	0	8	0	0	4	39	1.6%	
26-Jul	2	0	0	0	0	0	4	0	0	0	0	2	4	8	2	12	6	4	6	50	2.1%	
27-Jul	2	0	0	0	0	0	3	0	2	4	0	-2	8	0	10	0	0	6	12	45	1.9%	
28-Jul	3	0	0	0	0	0	6	0	0	0	0	0	0	4	2	18	14	34	80	3.3%		
29-Jul	1	0	0	0	0	1	6	1	1	1	1	0	0	3	5	9	13	12	30	84	3.5%	
30-Jul	0	0	0	0	0	2	7	2	2	2	2	0	0	6	6	16	8	10	26	89	3.7%	
31-Jul	0	0	0	0	0	4	8	0	0	0	1	0	2	2	8	12	28	20	16	101	4.2%	
1-Aug	8	0	0	0	0	0	39	0	0	0	0	0	2	12	6	8	2	12	20	109	4.5%	
2-Aug	8	0	0	0	0	0	23	2	0	0	0	12	6	6	2	0	2	2	0	63	2.6%	
3-Aug	0	0	0	0	2	0	26	4	8	0	0	2	2	6	8	2	8	2	72	3.0%		
4-Aug	2	2	0	0	0	2	18	4	4	0	2	4	2	0	0	4	2	0	4	50	2.1%	
5-Aug	2	1	0	0	0	1	17	3	3	1	3	5	3	0	1	2	1	1	3	47	1.9%	
6-Aug	2	0	0	2	0	-2	16	2	2	2	4	6	4	0	2	0	0	2	2	44	1.8%	
7-Aug	0	0	0	0	0	0	24	4	6	6	4	2	0	0	2	8	4	4	2	66	2.7%	
8-Aug	0	0	0	0	0	0	17	2	0	0	0	6	6	0	2	8	6	4	4	55	2.3%	
9-Aug	0	0	0	0	0	0	23	4	2	8	2	4	2	0	6	2	10	6	4	73	3.0%	
10-Aug	0	0	0	0	0	0	32	4	8	0	0	2	4	6	8	2	8	16	12	102	4.2%	
11-Aug	0	4	6	0	0	4	22	4	4	0	4	2	0	2	2	4	2	6	70	2.9%		
12-Aug	14	6	8	2	0	2	28	2	3	1	2	2	0	2	2	4	2	6	88	3.6%		
13-Aug	14	6	8	2	0	2	17	0	0	2	2	0	0	End of counting season					53	2.2%		
T	115	103	69	110	103	126	514	52	63	~4	57	80	106	82	116	143	157	165	203	27		
	4.8%	4.3%	2.9%	4.5%	4.3%	5.2%	21.3%	2.1%	2.6%		2.4%	3.3%	4.4%	3.4%	4.8%	5.9%	6.5%	6.8%	8.4%			

Table 1. Reported hourly chum salmon observations at the Niukluk River counting station, Norton Sound, 1998.

Date	Outlined areas indicate hours not counted																								Total	% of Total		
	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300				
4-Jul	38	36	60	10	8	4							10	0	12	50	114	36	140	126	74	50	66	32	866	2.4%		
5-Jul	108	72	36	10	0	-2							-8	-8	0	2	16	56	108	120	178	394	284	100	1,466	4.0%		
6-Jul	52	32	120	66	82	38							12	78	54	16	42	372	220	142	372	448	134	2,280	6.2%			
7-Jul	222	454	248	328	388	130	56	14	0	-2	-8	0	4	2	-2	0	6	2	58	178	164	212	322	394	3,170	8.7%		
8-Jul																												
9-Jul	56	32	40	10	14	8							0	6	28	170	34	28	30	34	34	124	40	234	922	2.5%		
10-Jul	278	270	192	182	122	102							-2	6	28	34	152	162	84	24	8	78	56	238	2,014	5.5%		
11-Jul	222	556	268	178	378	190							0	2	0	10	16	14	36	316	398	378	344	392	3,698	10.1%		
12-Jul	500	112	308	154	162	126							2	6	12	8	2	18	68	116	164	130	124	250	2,262	6.2%		
13-Jul	334	154	242	164	202	262							0	0	2	6	48	70	148	196	356	270	228	260	2,942	8.1%		
14-Jul	148	112	56	30	58	80	118	30	0	16	-8	16	20	32	36	78	98	32	62	16	206	104	98	152	1,590	4.4%		
15-Jul																												
16-Jul	150	154	114	48	94	168							-10	-24	-8	24	38	74	176	320	156	56	244	350	2,124	5.8%		
17-Jul	232	278	160	218	186	290							-18	-2	-2	36	24	14	180	226	170	190	204	92	2,478	6.8%		
18-Jul	234	206	188	46	64	106							6	22	40	26	34	68	46	78	38	76	58	80	1,416	3.9%		
19-Jul	130	116	104	8	16	64							-8	0	10	4	4	8	18	16	8	20	62	54	630	1.7%		
20-Jul	114	52	40	18	36	50							-2	-2	-2	58	42	58	80	74	98	112	102	928	2.5%			
21-Jul	204	196	206	66	96	188	186	76	24	6	-2	-2	12	18	76	112	56	218	184	132	138	238	252	192	2,872	7.9%		
22-Jul																												
23-Jul	80	92	12	0	4	8							20	8	20	44	22	22	32	38	8	12	4	24	450	1.2%		
24-Jul	2	8	-2	12	0	2							-26	2	0	18	18	60	102	54	74	60	58	90	532	1.5%		
25-Jul	38	4	16	4	8	8							-14	0	-6	4	20	28	8	56	18	24	50	46	312	0.9%		
26-Jul	44	24	14	14	6	46							-2	0	12	2	16	38	44	28	8	72	66	62	494	1.4%		
27-Jul	104	44	12	12	0	10							2	10	10	14	50	40	98	46	68	32	24	40	616	1.7%		
28-Jul	38	32	10	6	6	8	30	2	12	2	4	4	-2	-2	-2	4	18	48	48	56	36	64	60	516	1.4%			
29-Jul																												
30-Jul	22	10	6	8	2	2							2	2	4	6	16	24	36	46	16	30	34	38	304	0.8%		
31-Jul	46	30	0	4	0	12							-2	2	6	8	32	22	12	18	68	58	68	384	1.1%			
1-Aug	38	12	4	10	2	0							-2	4	10	6	34	24	24	22	18	12	2	36	256	0.7%		
2-Aug	18	12	-2	2	2	0							-4	-4	8	20	12	4	10	6	10	-2	10	20	122	0.3%		
3-Aug	10	4	2	2	2	0							0	-4	-6	6	-4	-2	8	10	0	10	6	18	62	0.2%		
4-Aug	0	0	0	4	2	0	0	0	4	4	0	-2	2	-4	0	8	6	6	0	8	26	6	20	100	0.3%			
5-Aug	4	4	4	10	0	0																			22	0.1%		
6-Aug	0	4	0	2	2	0							4	0	0	0	2	-2	4	4	2	-2	8	2	30	0.1%		
7-Aug	2	4	10	2	2	2							0	0	2	4	4	12	32	28	24	20	8	44	200	0.5%		
8-Aug	24	30	24	12	6	10							0	2	4	8	2	4	-6	0	10	0	24	26	180	0.5%		
9-Aug	12	18	8	18	6	0							4	0	-2	2	-2	2	6	0	8	12	30	28	150	0.4%		
10-Aug	32	18	8	8	10	4							0	-2	4	2	-2	2	2	2	4	14	10	2	118	0.3%		
11-Aug	-2	10	-6	2	12	8	4	6	0	0	2	-4	2	2	0	0	-4	2	-4	2	0	0	-4	26	0.1%			
12-Aug	0	2	0	2	2	0							2	0	0	0	0	0	0	0	0	0	0	6	0.0%			
13-Aug													2	0	0	0	End of counting season										2	0.0%
Total	3,534	3,194	2,502	1,670	1,980	1,924	394	128	40	26	-12	12	-10	86	374	762	928	1,224	2,240	2,610	2,658	3,222	3,414	3,640	36,540			
	9.7%	8.7%	6.8%	4.6%	5.4%	5.3%	1.1%	0.4%	0.1%	0.1%	0.0%	0.0%	0.0%	0.2%	1.0%	2.1%	2.5%	3.3%	6.1%	7.1%	7.3%	8.8%	9.3%	10.0%	100.0%			

Table 8. Reported hourly pink salmon observations at the Niukluk River counting tower, Norton Sound, 1998.

		Outlined areas indicate hours not counted																										
Date		0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	Total	% of Total	
4-Jul		32	30	38	20	10	42							0	0	14	18	128	88	140	126	74	50	86	16	912	0.1%	
5-Jul		54	136	118	20	4	12							-8	-2	2	2	124	66	186	212	242	424	254	222	2,068	0.2%	
6-Jul		116	182	174	196	266	150							62	434	164	106	70	348	314	294	992	932	548	548	5,348	0.4%	
7-Jul		610	1,318	1,254	1,334	2,746	1,532	472	108	0	-24	-44	-4	-2	0	6	6	74	78	248	1,712	2,746	2,754	3,978	3,720	24,622	2.0%	
8-Jul																												
9-Jul		834	992	602	316	182	206							12	114	436	840	338	200	498	496	1,186	3,818	2,016	4,964		18,050	1.5%
10-Jul		8,082	13,928	7,710	7,120	2,630	3,866							-16	58	606	480	1,950	2,818	2,628	1,192	1,126	1,954	2,786	4,882		63,800	5.2%
11-Jul		3,562	10,110	5,438	4,294	6,332	3,830							-34	-10	-42	52	68	124	428	9,418	10,122	11,362	10,528	10,442		86,024	7.0%
12-Jul		9,542	3,116	5,432	3,348	3,884	4,094							-12	0	20	286	38	660	1,674	2,812	8,216	6,278	6,810	10,654		66,852	5.4%
13-Jul		14,262	8,536	6,380	3,040	3,400	7,908							62	-74	-4	106	1,344	1,596	1,856	4,650	15,142	11,272	10,090	11,654		101,220	8.2%
14-Jul		10,862	7,526	2,658	1,298	1,300	4,986	6,136	2,432	126	32	180	410	442	814	1,258	2,240	5,282	1,674	3,200	1,104	7,592	4,246	6,916	8,152		80,866	6.6%
15-Jul																												
16-Jul		8,380	6,990	3,656	1,596	2,064	4,958							-882	-1,462	-324	202	944	2,186	7,994	11,882	8,956	6,218	11,270	25,470		100,098	8.1%
17-Jul		27,468	15,150	20,314	6,546	8,894	8,696							-1,322	-870	-948	-294	-162	112	6,872	11,672	11,764	13,000	10,532	6,666		144,090	11.7%
18-Jul		14,432	9,404	6,720	1,156	1,000	4,768							330	832	2,930	2,476	2,618	3,598	3,394	4,110	4,500	5,064	6,248	6,602		80,182	6.5%
19-Jul		8,466	6,794	2,342	252	332	1,564							-436	210	534	654	2,468	800	968	1,470	2,112	4,458	3,028		36,016	2.9%	
20-Jul		4,694	3,380	1,052	352	306	1,336							-246	-208	-118	1,632	2,720	2,924	6,924	7,742	8,568	10,442	10,130		61,630	5.0%	
21-Jul		11,282	12,510	6,756	1,838	2,204	5,862	13,174	7,060	3,214	798	-128	-4	134	1,816	9,868	11,546	5,844	20,950	17,778	17,980	11,022	14,310	16,484	9,658		201,956	16.4%
22-Jul																												
23-Jul		7,964	4,158	312	52	32	2,662							3,892	3,750	2,990	5,666	4,912	5,344	3,712	2,684	2,074	738	12	-276		50,678	4.1%
24-Jul		-410	-610	-250	2	-188	-1,378							-5,898	-4,252	-2,790	-1,688	-606	130	1,122	826	1,046	1,678	1,652	3,094		-8,520	-0.7%
25-Jul		272	-74	66	70	114	266							8	2	218	152	428	1,052	850	1,258	774	908	1,268	2,170		9,802	0.8%
26-Jul		1,242	1,162	372	178	234	738							-268	-346	264	248	258	850	1,256	968	414	1,536	1,888	1,950		12,944	1.1%
27-Jul		3,102	1,472	252	118	50	386							-28	48	92	108	500	508	1,290	2,100	1,266	1,132	1,128	1,746		15,270	1.2%
28-Jul		748	756	122	38	14	176	254	64	108	10	88	100	116	28	64	182	446	578	1,422	1,420	1,368	1,922	2,302	1,830		14,156	1.1%
29-Jul																												
30-Jul		1,336	310	74	34	22	186							146	126	210	196	296	520	1,622	1,898	1,900	1,532	1,790	1,630		13,828	1.1%
31-Jul		1,826	928	100	64	64	286							106	196	166	224	396	958	1,386	1,486	1,802	2,256	2,122		14,366	1.2%	
1-Aug		1,482	194	86	52	56	20							4	90	64	122	486	506	854	756	1,070	672	674	950		8,144	0.7%
2-Aug		210	176	68	14	-8	12							108	232	10	226	284	254	256	-74	120	210	174	234		2,506	0.2%
3-Aug		282	18	2	24	22	28							222	342	160	228	174	304	68	100	212	356	332	182		3,056	0.2%
4-Aug		24	30	32	28	22	82	68	100	294	264	176	232	218	250	214	220	144	156	108	250	296	284	208		3,982	0.3%	
5-Aug		36	18	24	92	58	54																				282	0.0%
6-Aug		32	44	40	44	56	54							182	166	238	288	200	266	88	180	218	110	124	234		2,564	0.2%
7-Aug		60	82	12	20	34	24							150	120	256	238	282	318	228	406	378	552	470	452		4,082	0.3%
8-Aug		204	74	82	44	26	60							178	270	244	342	398	380	122	170	116	182	178	244		3,314	0.3%
9-Aug		80	34	30	52	12	10							298	354	326	308	292	214	44	88	118	150	68	168		2,646	0.2%
10-Aug		42	32	32	18	12	-10							184	210	174	152	178	200	234	206	224	196	174	130		2,388	0.2%
11-Aug		98	200	68	66	66	34	80	66	252	186	210	164	136	116	120	126	96	32	46	38	30	-2	60	104		2,392	0.2%
12-Aug		108	114	84	68	100	60																				534	0.0%
13-Aug																			64	92	36						192	0.0%
Total		141,416	109,220	72,252	33,804	36,352	57,566	20,184	9,830	3,994	1,266	482	898	-2,224	2,982	17,756	25,984	29,356	51,416	65,248	90,232	105,304	106,380	118,588	134,054	1,232,340		
		11.5%	8.9%	5.9%	2.7%	2.9%	4.7%	1.6%	0.8%	0.3%	0.1%	0.0%	0.1%	-0.2%	0.2%	1.4%	2.1%	2.4%	4.2%	5.3%	7.3%	8.5%	8.6%	9.6%	10.9%	100.0%		

Table reported hourly king salmon observations at the Niukluk River counting tower, Sound, 1998.

Date	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	Total	% of Total			
4-Jul	0	0	0	0	0	0								0	0	2	0	0	0	14	12	0	4	0	0	32	16.7%		
5-Jul	8	0	0	0	0	0	4							0	0	0	0	0	0	4	0	0	2	2	0	20	10.4%		
6-Jul	2	6	2	4	0	2								2	0	4	4	4	-2	0	0	0	2	2	2	32	16.7%		
7-Jul	0	2	0	4	0	2	2	2	0	2	0	0	0	0	0	0	0	0	0	4	0	2	2	4	26	13.5%			
8-Jul																													
9-Jul	0	0	0	0	0	0	0							0	0	0	4	0	0	0	0	0	0	0	0	4	2.1%		
10-Jul	0	10	0	0	0	2	0							0	-2	0	6	0	2	0	2	0	0	0	0	20	10.4%		
11-Jul	2	0	2	0	2	0	0							0	0	0	0	0	0	0	0	0	0	0	0	6	3.1%		
12-Jul	0	0	0	2	2	4								0	2	0	0	0	0	2	0	0	0	2	0	14	7.3%		
13-Jul	2	-2	0	0	4	0								0	0	2	0	0	0	0	0	0	2	0	0	8	4.2%		
14-Jul	2	0	-2	0	2	0	0	0	0	0	0	0	2	0	0	0	-2	4	0	0	0	2	0	0	0	8	4.2%		
15-Jul																													
16-Jul	0	0	0	0	0	0	0							0	0	0	0	0	2	0	0	0	0	0	2	0	4	2.1%	
17-Jul	0	0	2	0	0	0	0							0	0	2	0	0	0	0	0	0	0	0	0	2	6	3.1%	
18-Jul	0	0	0	0	0	0	0							-2	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0.0%
19-Jul	0	4	0	2	2	2								0	0	0	0	0	0	0	0	0	0	0	0	10	5.2%		
20-Jul	0	0	0	0	0	-2								0	-2	0	0	0	0	0	0	0	0	0	2	-2	-1.0%		
21-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	1.0%			
22-Jul																													
23-Jul	0	0	0	0	0	0	0							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%	
24-Jul	0	0	0	0	0	0	0							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%	
25-Jul	0	0	0	0	0	0	0							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%	
26-Jul	0	0	0	0	0	0	0							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%	
27-Jul	0	0	0	0	0	0	0							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%	
28-Jul	0	0	0	0	0	-2	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0.0%		
29-Jul																													
30-Jul	0	0	0	0	0	0	0							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%	
31-Jul	0	0	0	0	0	0	0							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%	
1-Aug	0	0	0	0	0	0	0							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%	
2-Aug	0	0	0	0	0	0	0							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%	
3-Aug	0	0	0	0	0	0	0							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%	
4-Aug	0	0	0	0	0	0	0							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%	
5-Aug	0	0	0	0	0	0	0																			0	0.0%		
6-Aug	0	0	0	0	0	0	0							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%	
7-Aug	0	0	0	0	0	0	0							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%	
8-Aug	0	0	0	0	0	0	0							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%	
9-Aug	0	0	0	0	0	0	0							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%	
10-Aug	0	2	0	0	0	0	0							0	0	0	0	0	0	0	0	0	0	0	0	2	1.0%		
11-Aug	0	0	0	-2	0	0	0							0	2	0	0	0	0	0	0	0	0	0	0	0	0	0.0%	
12-Aug	0	0	0	0	0	0	0												0	0	0	0	0	0	0	0	0.0%		
																			0	0	0								
																			0	0	0								
																			End of counting season										
Total	16	22	4	10	14	10	4	2	0	2	0	2	-2	0	6	12	10	8	20	20	2	12	10	8	192	100.0%			
	8.3%	11.5%	2.1%	5.2%	7.3%	5.2%	2.1%	1.0%	0.0%	1.0%	0.0%	1.0%	-1.0%	0.0%	3.1%	6.3%	5.2%	4.2%	10.4%	10.4%	1.0%	6.3%	5.2%	4.2%					

Table 10. Reported hourly coho salmon observations at the Niukluk River counting tower, Norton Sound, 1998.

Outlined areas indicate hours not counted																							% of Total						
Date		0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	Total			
4-Jul		0	0	0	0	0	0								0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%	
5-Jul		0	0	0	0	0	0								0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%	
6-Jul		0	0	0	0	0	0								0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%	
7-Jul		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%			
8-Jul																													
9-Jul		0	0	0	0	0	0								0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%	
10-Jul		0	0	0	0	0	0								0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%	
11-Jul		0	0	0	0	0	0								0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%	
12-Jul		0	0	0	0	0	0								0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%	
13-Jul		0	0	0	0	0	0								0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%	
14-Jul		0	0	0	0	0	0								0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%	
15-Jul																													
16-Jul		0	0	0	0	0	0								0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%	
17-Jul		0	0	0	0	0	0								0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%	
18-Jul		0	0	0	0	0	0								0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%	
19-Jul		0	0	0	0	0	0								0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%	
20-Jul		0	0	0	0	0	0								0	0	0	0	0	0	0	0	0	0	0	0	2	0.3%	
21-Jul		0	0	0	0	0	0								0	0	0	0	0	0	0	0	0	0	0	0	0	8	1.3%
22-Jul															2	0	0	2	0	0	0	0	0	0	0	0	0		
23-Jul		2	0	0	6	0	0								0	0	0	0	0	0	0	0	0	0	0	0	8	1.3%	
24-Jul		0	0	0	2	0	0								0	0	2	0	0	2	0	0	4	0	0	0	10	1.7%	
25-Jul		0	0	0	2	0	0								0	2	2	2	0	2	0	0	0	2	0	0	12	2.0%	
26-Jul		0	0	8	2	0	0								0	0	0	0	0	0	0	0	0	0	0	0	10	1.7%	
27-Jul		0	2	6	0	0	0								0	0	0	0	0	0	0	6	0	0	0	0	14	2.3%	
28-Jul		2	0	0	0	0	0								0	0	0	0	2	2	0	0	0	2	8	6	22	3.7%	
29-Jul																													
30-Jul		0	0	0	0	0	0								0	0	0	0	0	0	0	2	0	6	2	0	10	1.7%	
31-Jul		4	2	0	0	0	0								0	0	0	0	0	0	0	2	0	2	4	2	16	2.7%	
1-Aug		2	4	2	0	0	0								0	0	0	0	0	0	4	4	2	0	0	2	20	3.3%	
2-Aug		2	2	0	0	2	0								2	0	0	0	0	0	0	2	0	0	0	0	10	1.7%	
3-Aug		2	2	0	0	0	0								0	0	0	0	0	2	2	6	8	2	8	0	32	5.3%	
4-Aug		0	0	0	0	0	0								2	0	0	2	2	0	-2	2	4	2	0	14	30	5.0%	
5-Aug		2	0	0	2	2	0								0	0	0	0	0	0	0	0	0	0	0	0	6	1.0%	
6-Aug		4	2	2	4	2	2								2	0	0	2	0	6	0	2	0	0	4	4	36	6.0%	
7-Aug		0	0	2	2	0	0								0	0	4	2	2	6	0	4	12	2	4	2	42	7.0%	
8-Aug		4	0	2	0	0	0								0	0	2	0	8	0	2	2	2	4	4	28	4.7%		
9-Aug		0	0	0	0	0	0								0	4	0	0	0	0	2	0	2	4	0	6	18	3.0%	
10-Aug		2	2	6	0	0	0								2	2	0	0	0	2	2	0	2	0	2	10	32	5.3%	
11-Aug		8	14	2	8	14	0								0	2	0	0	4	0	2	0	0	0	8	6	72	12.0%	
12-Aug		4	10	4	6	4	2								72	40	22										30	5.0%	
13-Aug																											134		
Total		38	40	34	34	24	4	2	0	2	2	6	0	8	10	82	48	34	24	22	28	38	22	44	56	602			
		6.3%	6.6%	5.6%	5.6%	4.0%	0.7%	0.3%	0.0%	0.3%	0.3%	1.0%	0.0%	1.3%		13.6%	8.0%	5.6%	4.0%	3.7%	4.7%	6.3%	3.7%	7.3%	9.3%	100.0%			

Table 1. Reported hourly Dolly Varden observations at the Niukluk River counting station, Norton Sound, 1998.

Date	Reported hourly Dolly Varden observations at the Niukluk River counting station, Norton Sound, 1998.																								% of Total		
	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300			
4-Jul	10	26	4	16	0	2							-2	0	2	2	2	0	6	0	0	0	0	0	0	68	4.0%
5-Jul	4	6	8	12	16	10							0	2	4	0	2	4	0	0	2	4	2	0	0	76	4.5%
6-Jul	22	8	6	4	6	8							0	0	0	0	0	0	0	0	4	4	6	2	0	70	4.1%
7-Jul	2	2	4	2	0	2	0	2	0	0	0	0	0	0	0	0	0	0	4	2	0	4	0	0	24	1.4%	
8-Jul																											
9-Jul	0	2	0	0	0	0							0	4	0	4	0	0	0	0	2	4	0	0	0	16	0.9%
10-Jul	0	2	0	0	0	2	0						2	2	0	0	0	6	2	10	2	2	2	0	0	32	1.9%
11-Jul	0	0	0	0	0	0	0						2	0	2	0	0	0	2	2	2	0	0	0	0	10	0.6%
12-Jul	0	0	0	0	0	0	0						0	0	2	2	0	0	0	0	2	0	0	0	0	6	0.4%
13-Jul	0	2	0	2	0	0	0						0	0	0	0	0	6	0	0	2	2	0	0	0	14	0.8%
14-Jul	0	0	0	4	0	0	0	0	2	0	0	4	0	2	0	0	0	0	0	0	2	12	0	0	32	1.9%	
15-Jul																											
16-Jul	6	12	4	18	12	2							0	0	0	2	0	0	4	0	0	4	0	2	0	66	3.9%
17-Jul	0	0	0	8	16	2							2	0	0	0	0	0	4	0	0	0	0	0	0	34	2.0%
18-Jul	2	4	2	12	20	46							0	0	0	2	0	0	0	0	0	0	0	0	0	86	5.1%
19-Jul	6	12	6	0	6	6							0	0	0	0	0	0	0	0	0	2	0	0	0	38	2.2%
20-Jul	0	0	6	2	8	6	0						2	0	0	0	2	2	0	0	2	0	0	2	0	30	1.8%
21-Jul	0	0	0	8	6	12	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32	1.9%	
22-Jul																											
23-Jul	0	0	2	0	0	0	0						4	2	4	2	10	18	10	12	8	0	0	2	0	74	4.4%
24-Jul	2	0	0	0	0	0	6						2	0	2	4	6	10	0	4	6	10	4	2	0	58	3.4%
25-Jul	0	0	0	0	0	0	0						0	0	4	10	4	4	2	0	8	0	0	4	0	36	2.1%
26-Jul	2	0	0	0	0	0	0						0	0	0	0	2	4	8	2	12	6	4	6	46	2.7%	
27-Jul	2	0	0	0	0	0	0	0					0	2	4	0	-2	8	0	10	0	0	6	12	42	2.5%	
28-Jul	2	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0	4	2	18	14	80	4.7%		
29-Jul																											
30-Jul	0	0	0	0	0	0	2						2	2	2	2	0	0	6	6	16	8	10	26	82	4.8%	
31-Jul	0	0	0	0	0	0	4						0	0	0	0	0	0	2	2	8	12	28	20	92	5.4%	
1-Aug	8	0	0	0	0	0	0						0	0	0	0	0	2	12	6	8	2	12	20	70	4.1%	
2-Aug	8	0	0	0	0	0	0						2	0	0	0	12	6	6	2	0	2	2	0	40	2.4%	
3-Aug	0	0	0	0	2	0	0						4	8	0	0	2	2	2	6	8	2	8	2	46	2.7%	
4-Aug	2	2	0	0	0	2	0	0	12	2	4	0	4	4	0	2	4	2	0	0	4	2	0	50	3.0%		
5-Aug	-2	0	4	2	0	0	0																		4	0.2%	
6-Aug	2	0	0	2	0	0	-2						2	2	2	4	6	4	0	2	0	0	2	2	28	1.7%	
7-Aug	0	0	0	0	0	0	0						4	6	6	4	2	0	2	8	4	4	4	2	42	2.5%	
8-Aug	0	0	0	0	0	0	0						2	0	0	0	6	6	0	2	8	6	4	4	38	2.2%	
9-Aug	0	0	0	0	0	0	0						4	2	8	2	8	2	0	6	2	10	6	4	54	3.2%	
10-Aug	0	0	0	0	0	0	0						4	8	0	0	2	4	6	8	2	8	16	12	70	4.1%	
11-Aug	0	4	6	0	0	4	0	0	10	6	4	4	4	4	0	4	2	0	2	2	4	2	6	70	4.1%		
12-Aug	14	6	8	2	0	2	0						2	2	0										32	1.9%	
13-Aug													2	2	0										4	0.2%	
Total	92	88	60	94	94	114	4	16	22	8	8	4	34	52	48	46	72	92	72	100	124	134	142	162	1,692		
	5.4%	5.2%	3.5%	5.6%	5.6%	6.7%	0.2%	0.9%	1.3%	0.5%	0.5%	0.2%	2.6%	3.1%	2.8%	2.7%	4.3%	5.4%	4.3%	5.9%	7.3%	7.9%	8.4%	9.6%	100.0%		

Outlined areas indicate hours not counted

Table 12. Age, sex and length composition of chum salmon beach seine samples, Niukluk River, Norton Sound, 1998.

		Brood Year and (Age Group)					
		1995 (0.2)	1994 (0.3)	1993 (0.4)	1992 (0.5)	1991 (0.6)	Total
Sampling Dates:	7/4 - 7/20/98						
Sample Size:	138						
Female	Percent of Sample	1.4%	30.4%	9.4%	2.2%	0.0%	43.5%
	Number in Sample	2	42	13	3	0	60
	Mean length (mm) ^a	563	567	578	581		
Male	Percent of Sample	0.0%	29.7%	25.4%	1.4%	0.0%	56.5%
	Number in Sample	0	41	35	2	0	78
	Mean length (mm) ^a		611	613	630		
Total	Percent of Sample	1.4%	60.1%	34.8%	3.6%	0.0%	100.0%
	Number in Sample	2	83	48	5	0	138
	Mean length (mm) ^a	563	589	603	601		

^a Length was from mid-eye to fork of tail.

Table 13. Niukluk River counting tower climatological and stream observations, Norton Sound 1998.

Date	Time	Air Temp °C	Water Temp °C	% Cloud Cover	Water Gauge	Water Visibility	Remarks
2-Jul	17:00				36.00		
3-Jul	7:00				34.50		
4-Jul	9:00	14	11	80%	33.00	Good	
5-Jul	9:00	15	10	2%	32.75	Good	
6-Jul	9:00	15	13	85%	31.50	Good	
7-Jul	9:00	14	12	98%	30.80	Good	
8-Jul	9:00	13	12	50%	30.75	Good	
9-Jul	12:00	16	15	50%	29.80	Good	
10-Jul	9:00	16	13	75%	29.00	Good	
11-Jul	9:30	17	12	5%	28.75	Good	
12-Jul	9:30	14	13	100%	28.75	Good	
13-Jul	9:30	14	12	100%	27.75	Good	
14-Jul	9:45	16	13	100%	26.50	Good	
15-Jul							
16-Jul	10:00	17	12	75%	26.75	Good	
17-Jul	9:45	14	13	75%	26.00	Good	
18-Jul	9:00	14	13	55%	25.25	Good	
19-Jul	9:15	14	14	85%	24.75	Good	
20-Jul	9:00	12	11		24.25	Good	
21-Jul	8:45	15	14	1%	23.75	Good	
22-Jul	9:00	18	15	10%	23.50	Good	
23-Jul	9:15	19	17	100%	23.50	Good	Rain
24-Jul	9:30	19	13	100%	28.75	Murky	
25-Jul	9:00	15	13	100%	27.50	Good	
26-Jul	9:00	15	13	97%	24.50	Good	
27-Jul	9:00	12	13	50%	23.75	Good	
28-Jul	9:00	11	13	100%	23.50	Good	
29-Jul							
30-Jul	12:45	15	14	100%	23.80	Good	
31-Jul	9:00	11	13	100%	22.80	Good	
1-Aug	9:45	15	14	100%	22.80	Good	Rain
2-Aug	9:30	12	12	100%	29.50	Poor	Mist
3-Aug	9:30	14	12	100%	26.80	Good	
4-Aug	9:15	12	12	100%	26.50	Good	
5-Aug	9:15	12	12	100%	26.50	Good	
6-Aug	9:15	10	10	100%	25.90	Good	
7-Aug	9:15	7	9	10%	25.50	Good	
8-Aug	9:15	9	10	100%	24.75	Good	
9-Aug	9:30	12	11	100%	24.00	Good	Drizzle
10-Aug	10:00	11	10	100%	24.00	Good	
11-Aug	9:00	11	10	100%	23.80	Good	Rain
12-Aug	10:00	10	10	100%	25.00	Good	Drizzle
13-Aug	10:00	13	11	100%	31.50	Fair	
14-Aug	10:00	10	10	100%	47.50	Murky	Rain
15-Aug	9:30	10	9	100%	55.50	Muddy	Rain
16-Aug							
17-Aug	10:00	6	8	50%	51.00	Murky	
18-Aug	10:00	10	9	100%	44.00	Murky	
19-Aug	10:00	10	9	100%	42.00	Murky	Rain - weir down
20-Aug	10:00	9	9	100%	>90.00	Muddy	
21-Aug	10:00	5	8	80%	70.00	Muddy	
22-Aug	10:00	6	8	50%	60.00	Muddy	
23-Aug	10:00	7	9	100%	55.00	Poor	
24-Aug	10:00	14	8	100%	>60.00	Poor	Rain
25-Aug	10:00	8	10	100%	66.00	Poor	Rain
26-Aug	10:00	8	5	100%	65.00	Poor	
27-Aug	11:00	8	9	100%	60.00	Poor	

Figure 1. Area location map of the Niukluk River counting tower project site, Norton Sound, 1998.

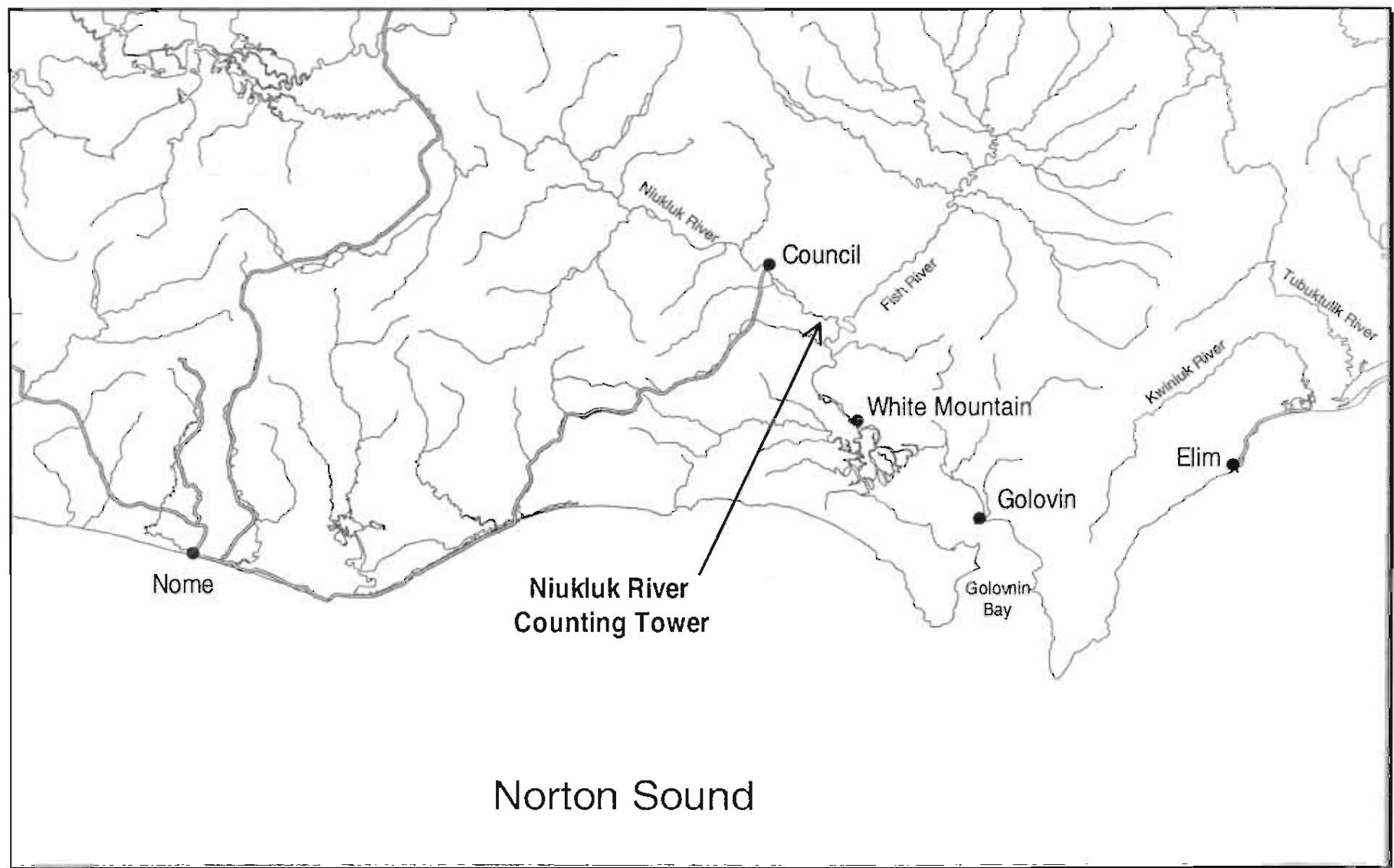


Figure 2. Cumulative passage of all salmonid species, except pink salmon, past the Niukluk River counting tower, Norton Sound, 1998.

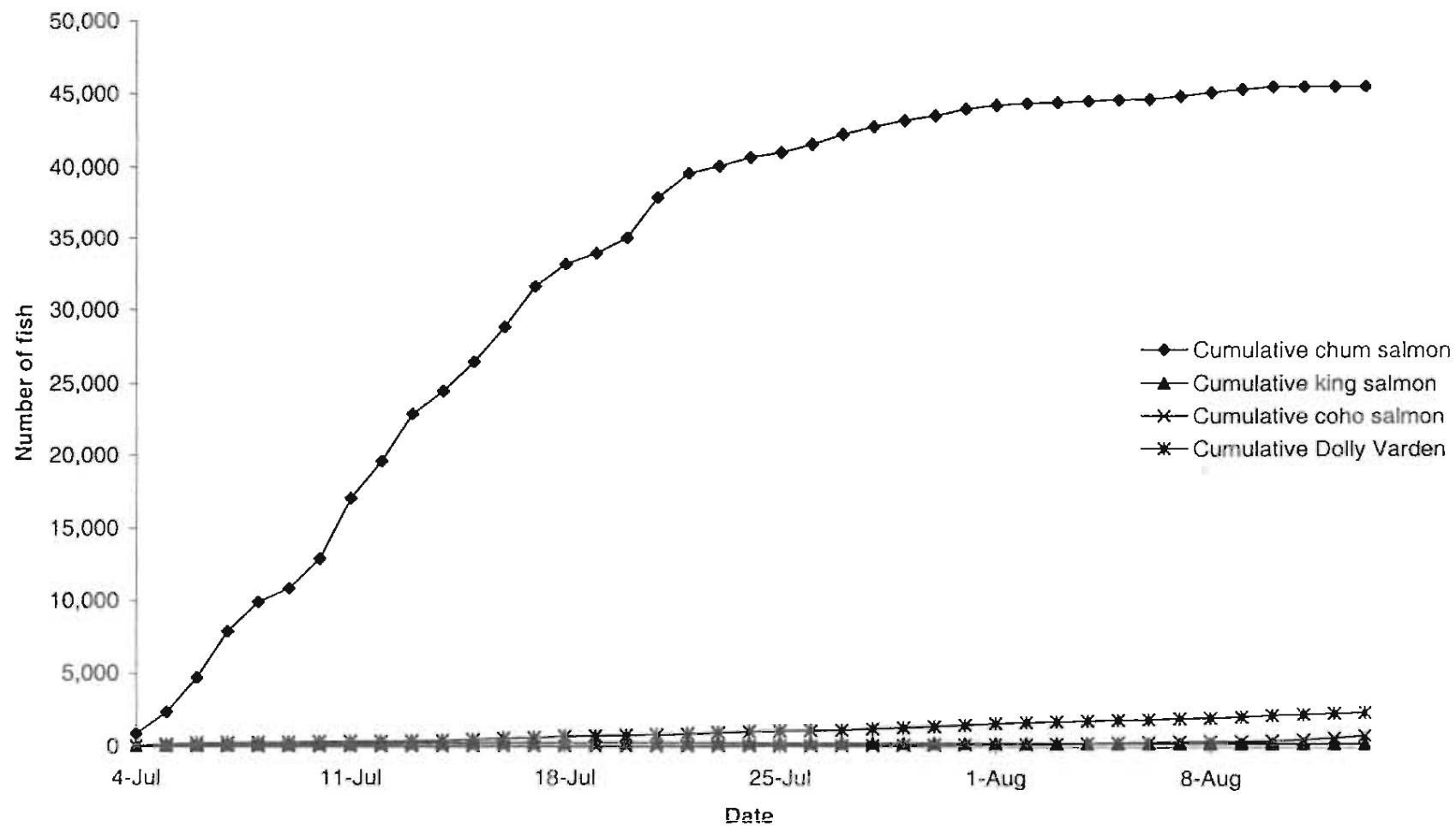


Figure 3. Daily chum salmon migration past the Niukluk River counting tower, Norton Sound, 1998.

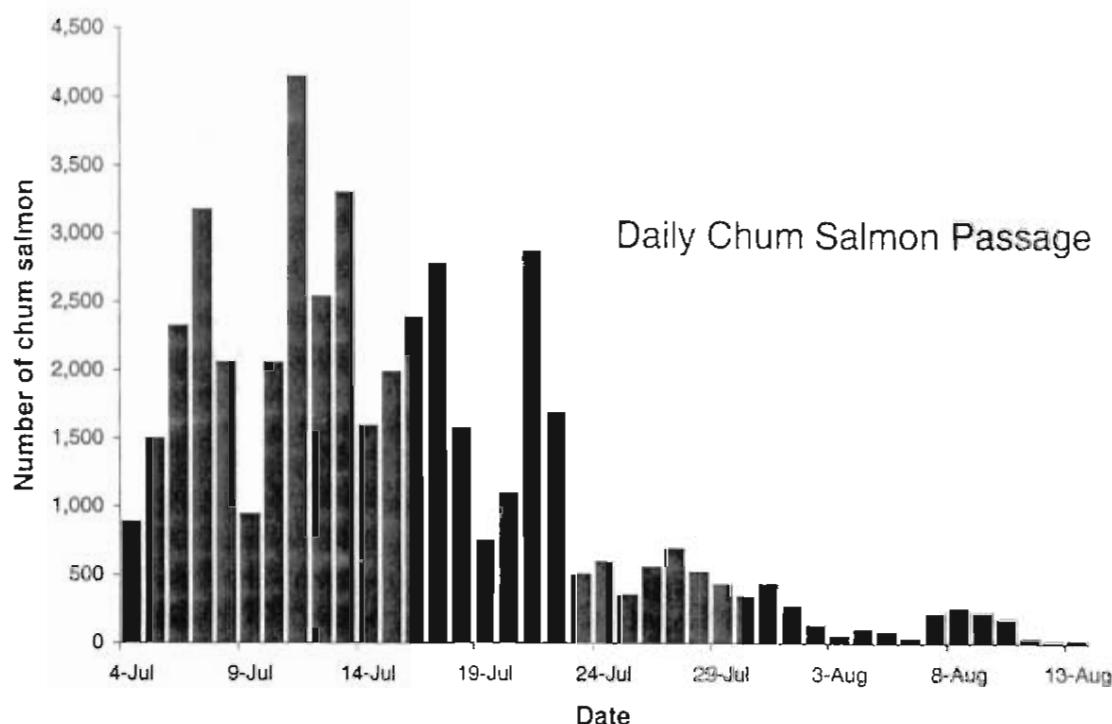


Figure 4. Cumulative chum salmon migration past the Niukluk River counting tower, Norton Sound, 1998.

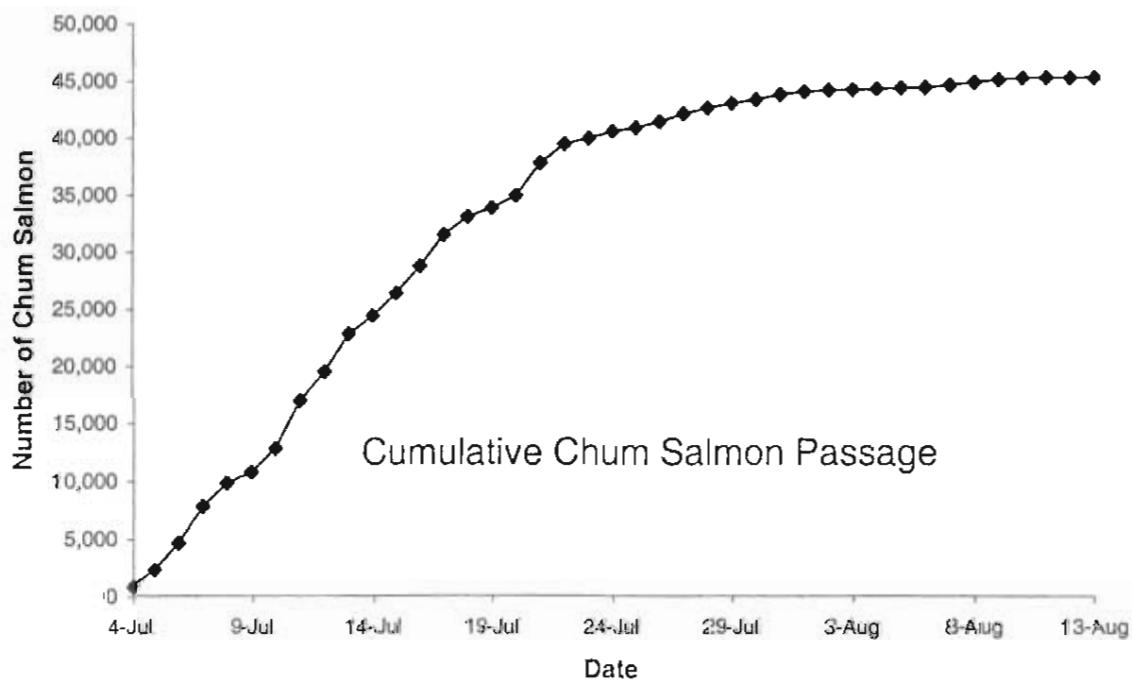


Figure 5. Daily pink salmon migration past the Niukluk River counting tower, Norton Sound, 1998.

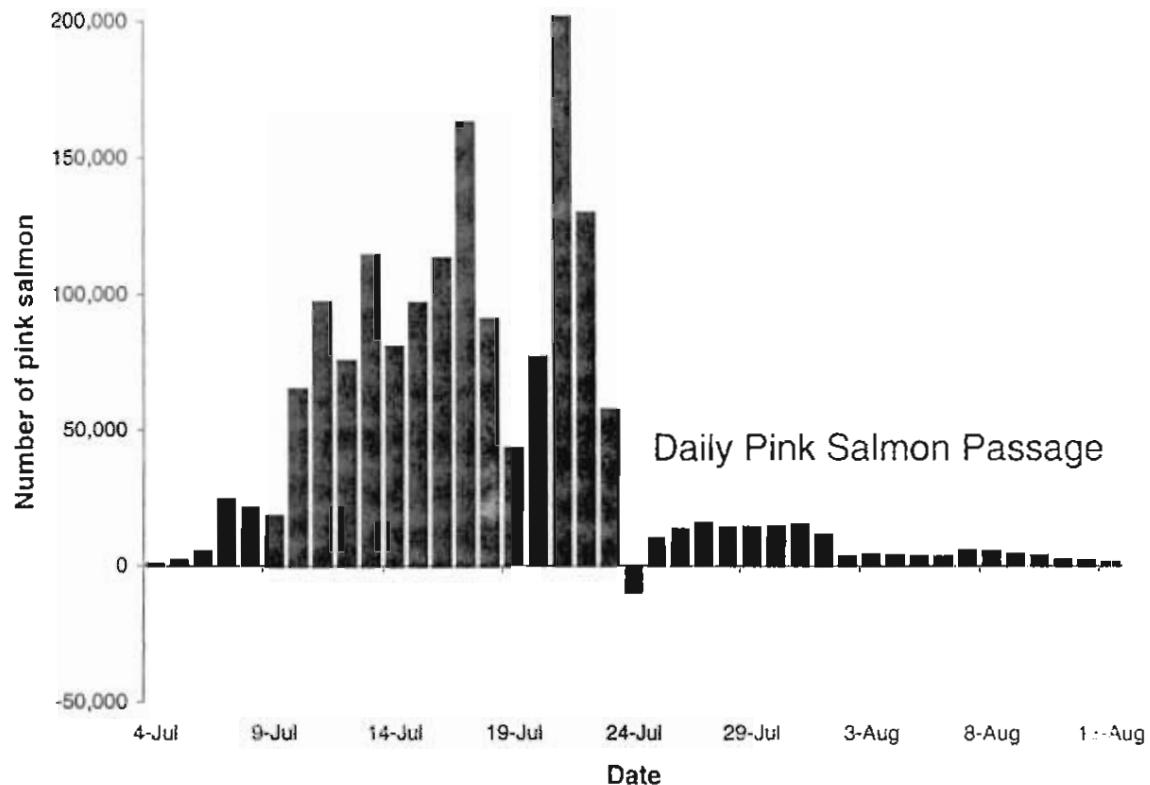


Figure 6. Cumulative pink salmon migration past the Niukluk River counting tower, Norton Sound, 1998.

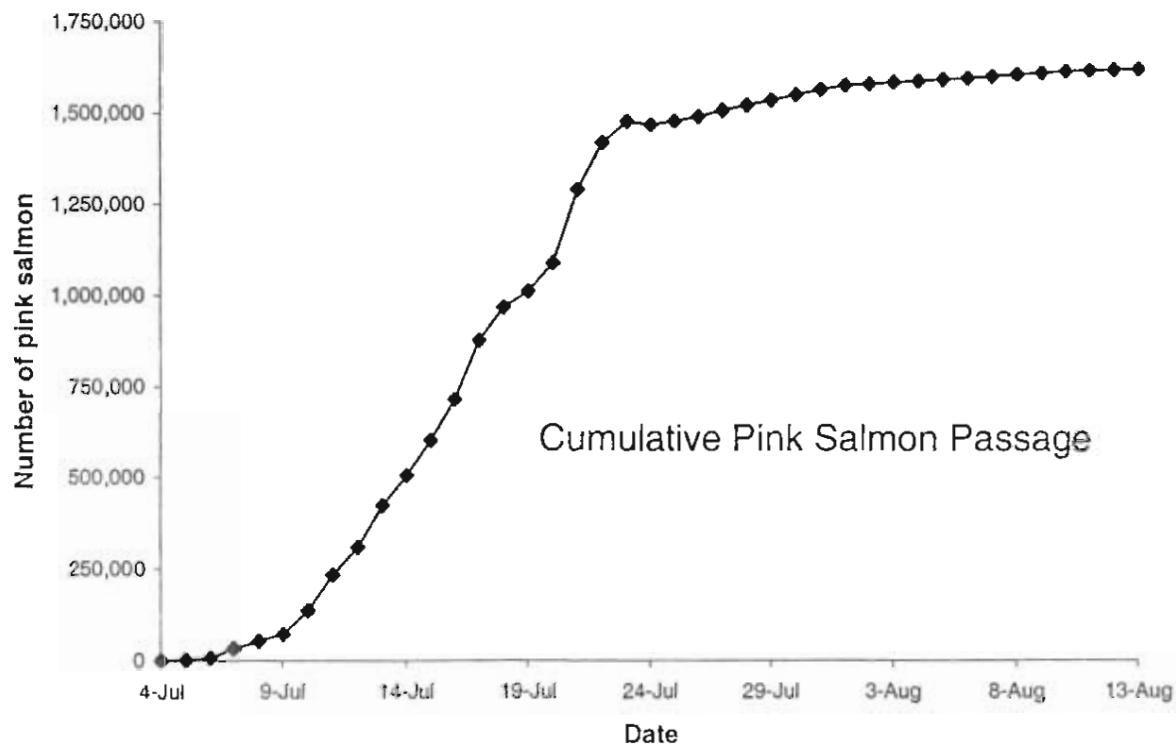


Figure 7. Daily king salmon migration past the Niukluk River counting tower, Norton Sound, 1998.

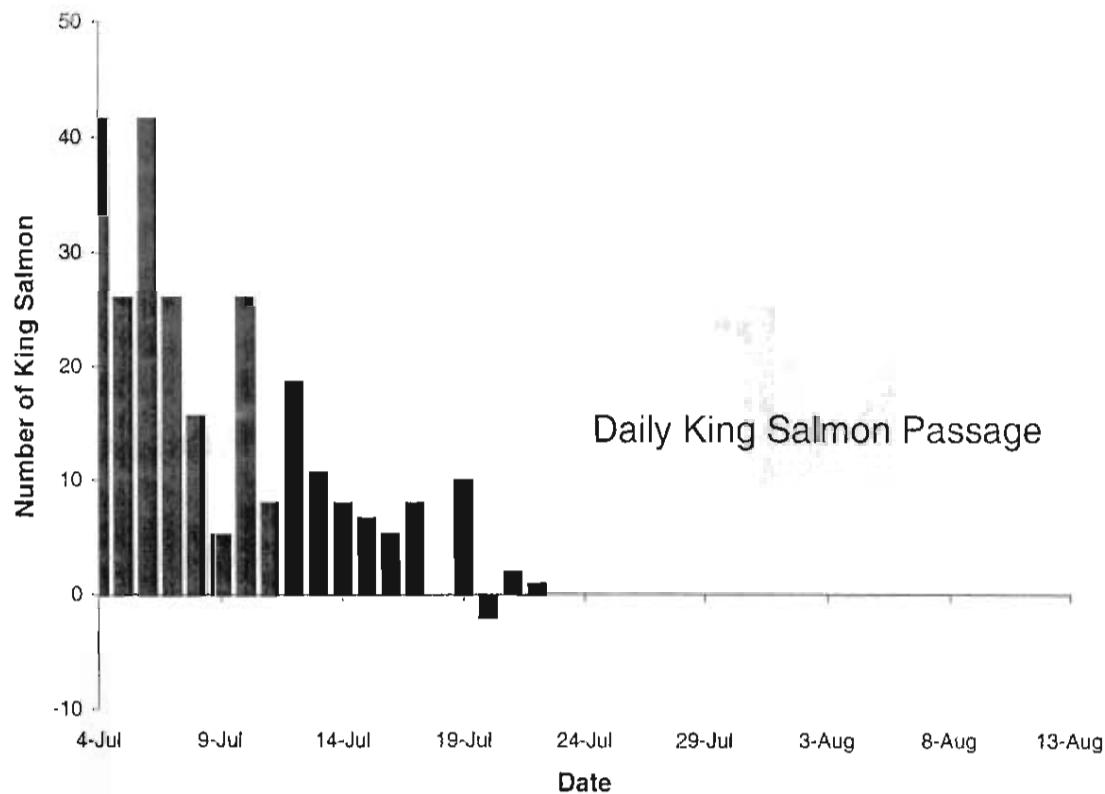


Figure 8. Cumulative king salmon migration past the Niukluk River counting tower, Norton Sound, 1998.

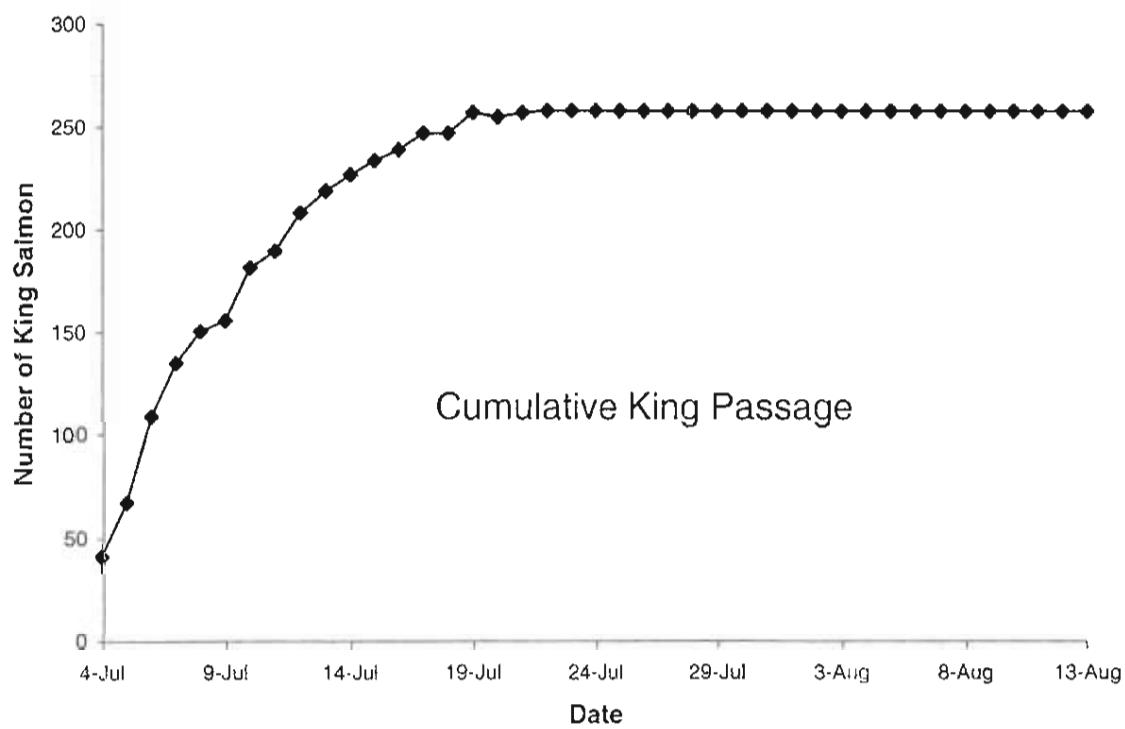


Figure 9. Daily coho salmon migration past the Niukluk River counting tower, Norton Sound, 1998.

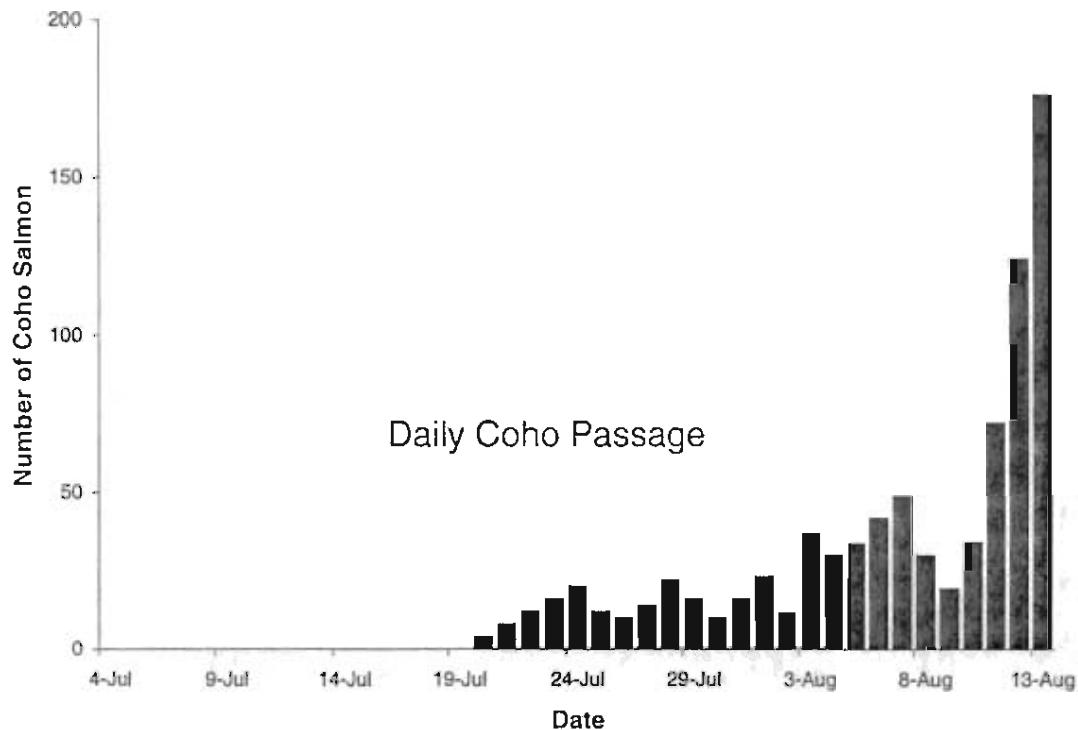


Figure 10. Cumulative coho salmon migration past the Niukluk River counting tower, Norton Sound, 1998.

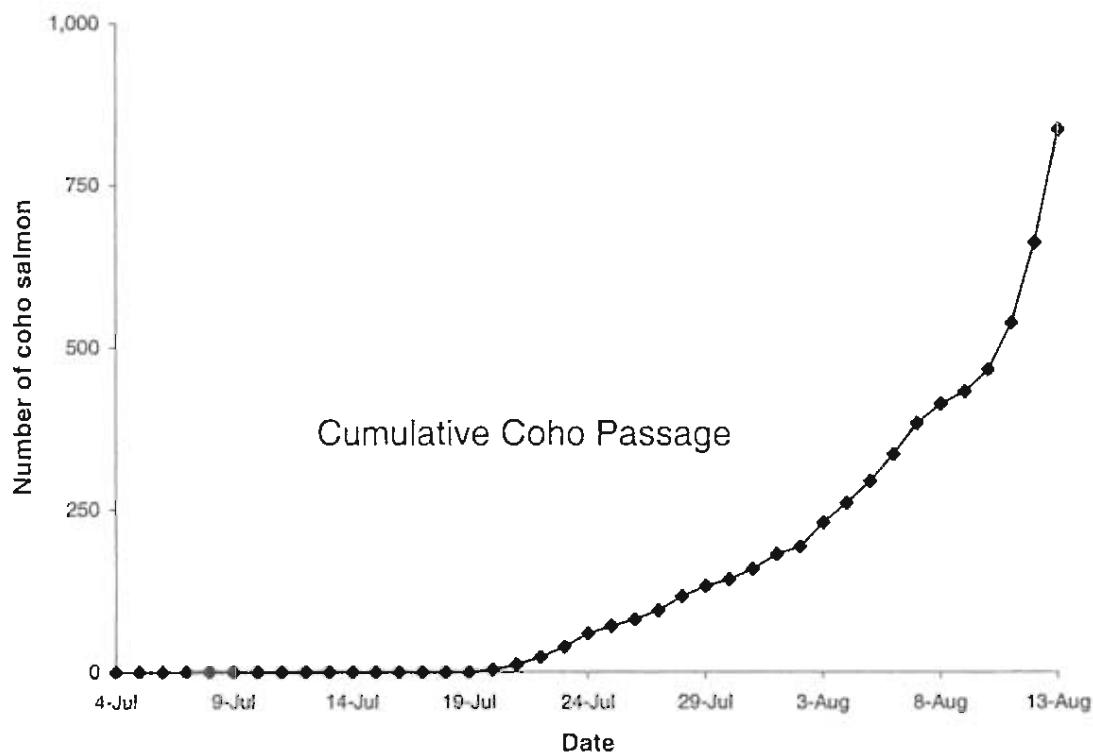


Figure 11. Daily Dolly Varden migration past the Niukluk River counting tower, Norton Sound, 1998.

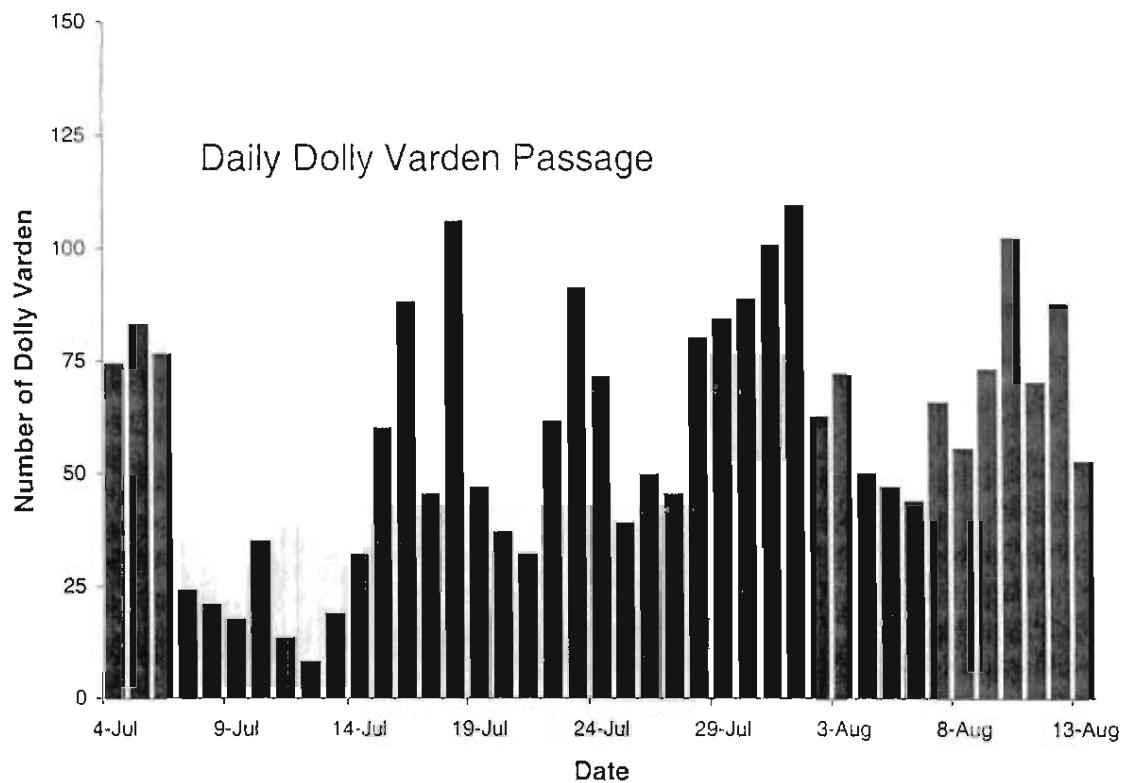


Figure 12. Cumulative Dolly Varden migration past the Niukluk River counting tower, Norton Sound, 1998.

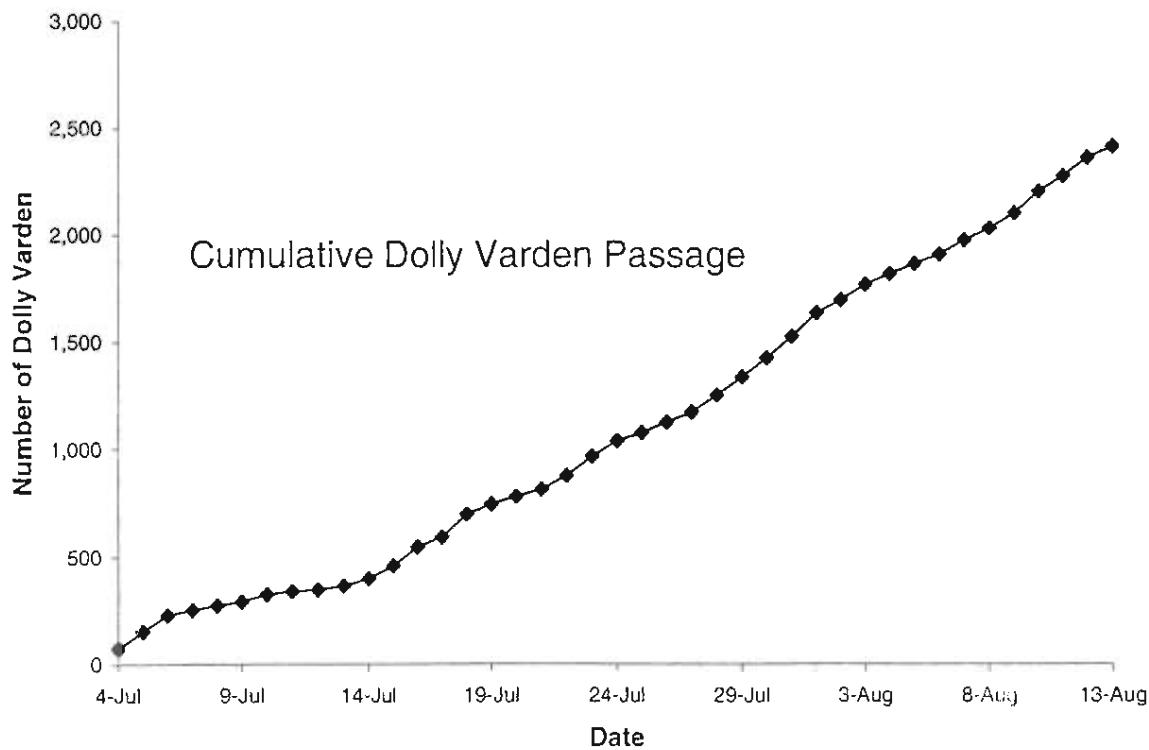


Figure 13. Diurnal pattern of chum salmon migration past the Niukluk River counting tower, Norton Sound, 1998.

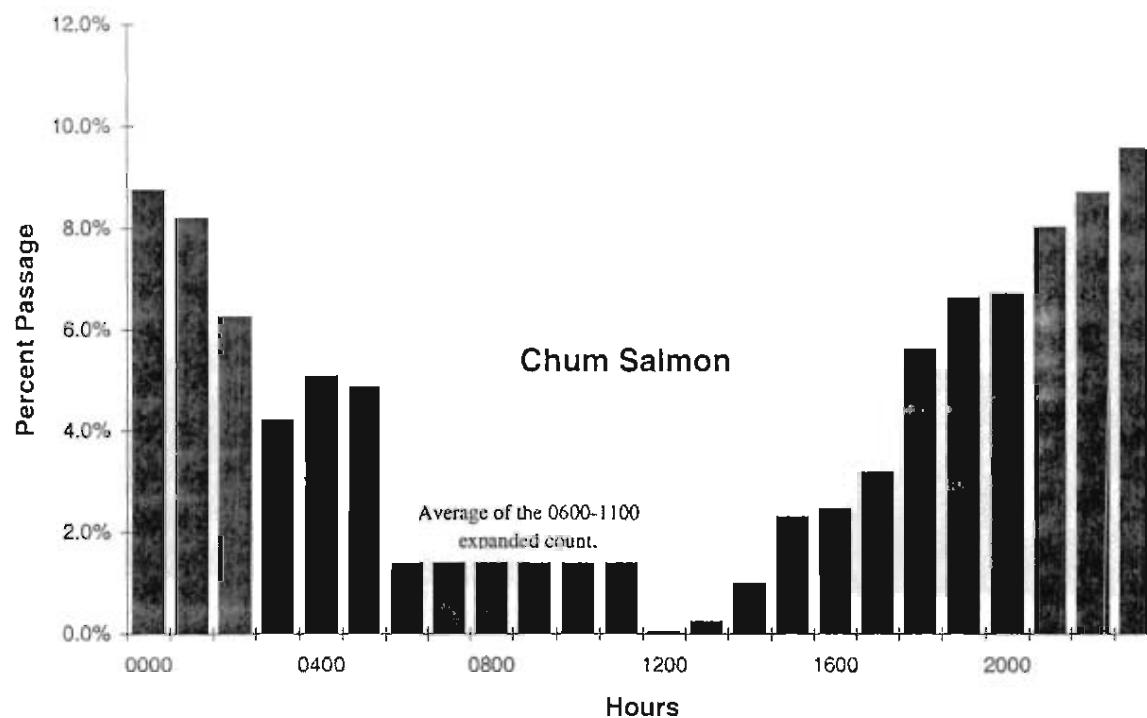


Figure 14. Diurnal pattern of pink salmon migration past the Niukluk River counting tower, Norton Sound, 1998.

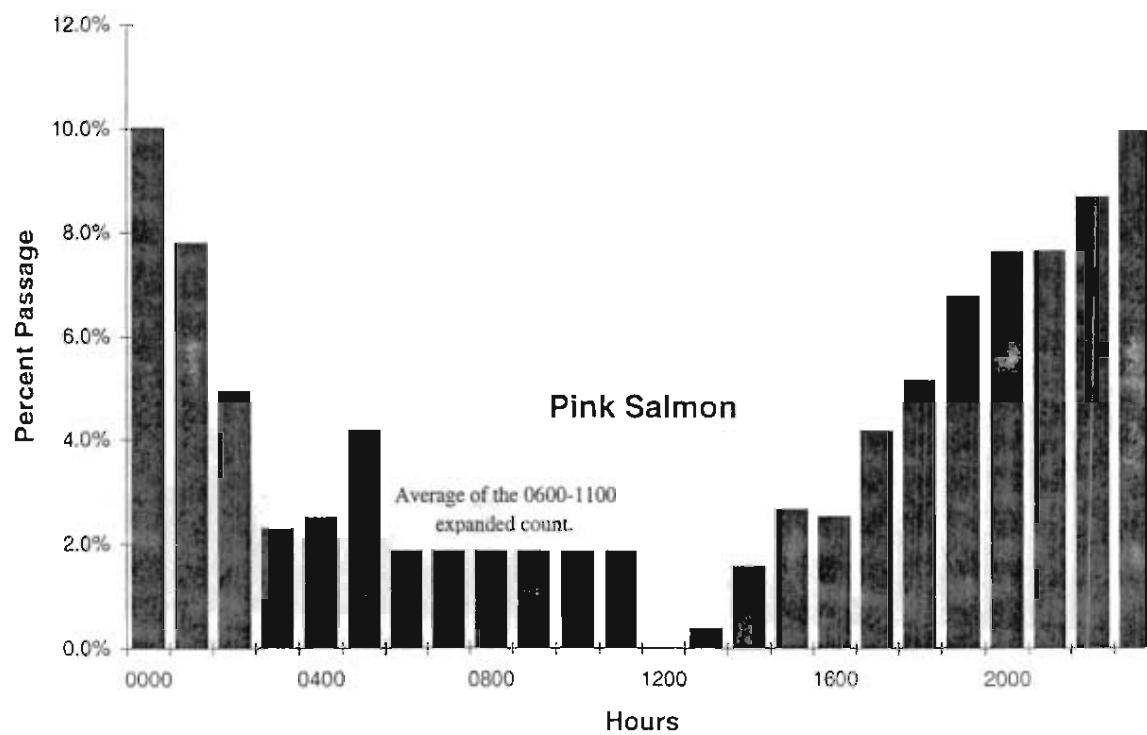


Figure 15. Diurnal pattern of king salmon migration past the Niukluk River counting tower, Norton Sound, 1998.

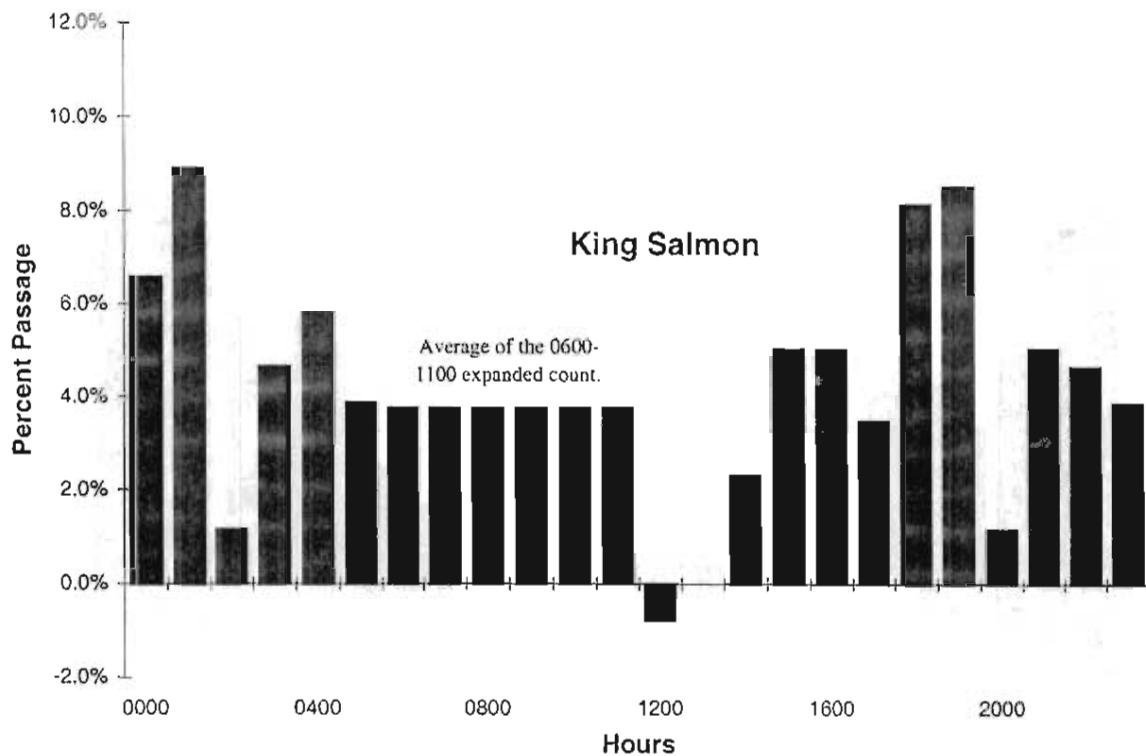


Figure 16. Diurnal pattern of coho salmon migration past the Niukluk River counting tower, Norton Sound, 1998.

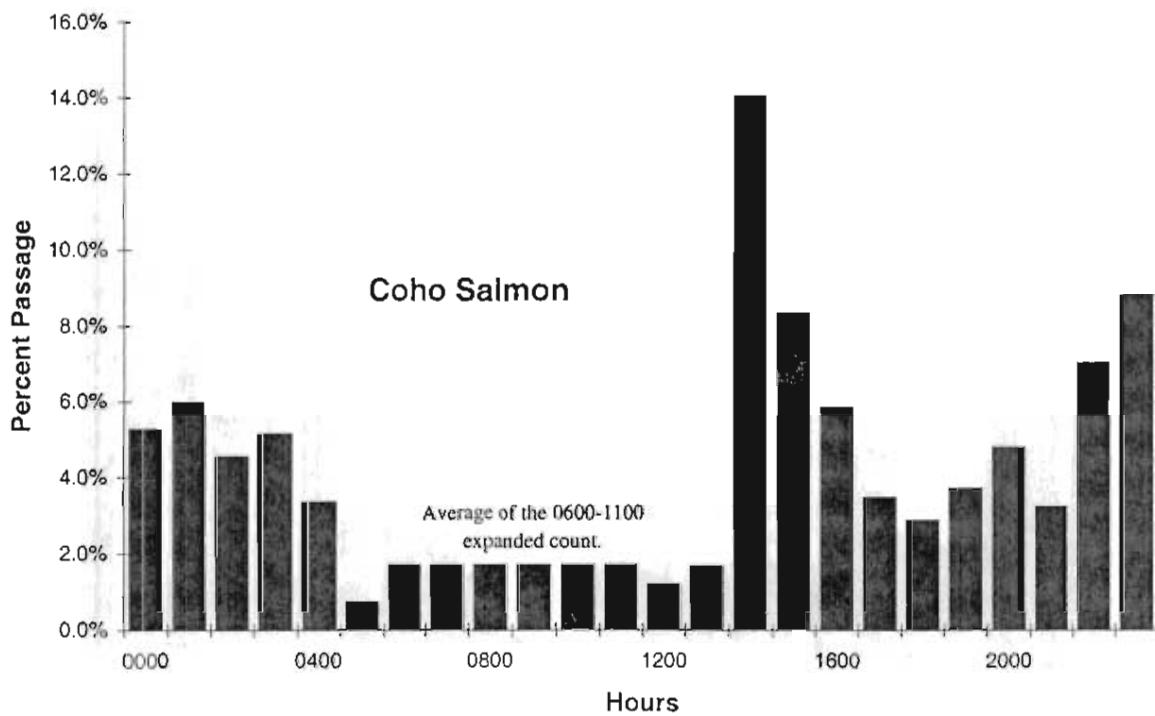


Figure 17. Diurnal pattern of Dolly Varden migration past the Niukluk River counting tower, Norton Sound, 1998.

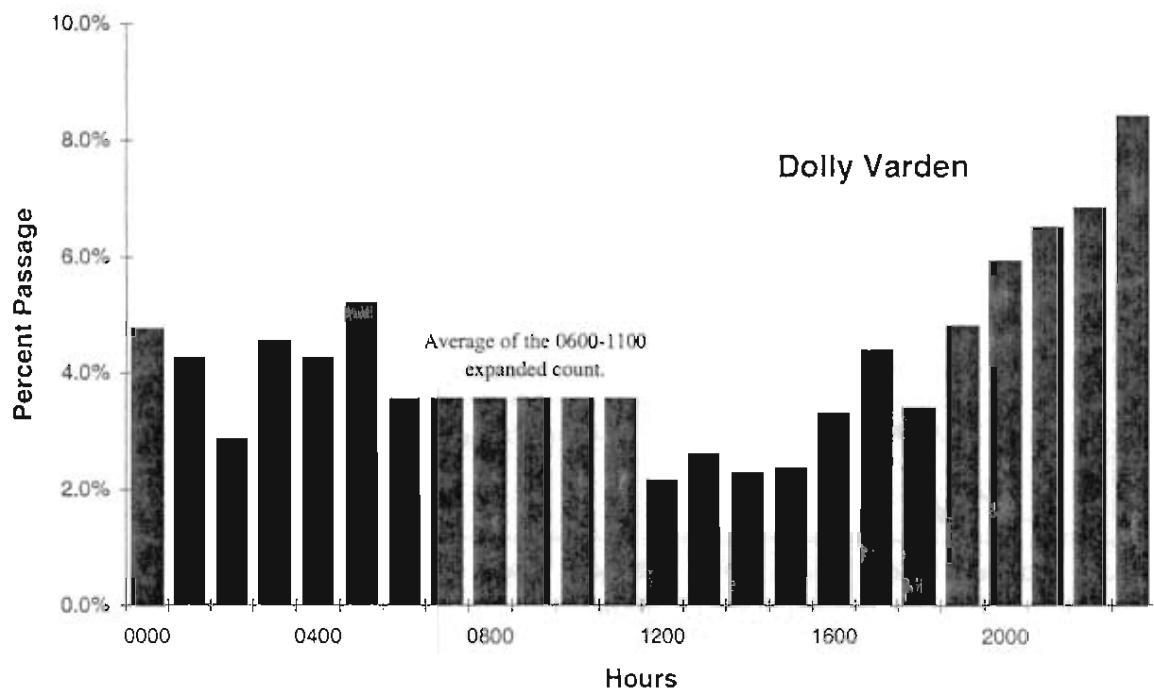


Figure 18. Chum salmon run-timing, Niukluk River counting tower, Norton Sound, 1995-1998.

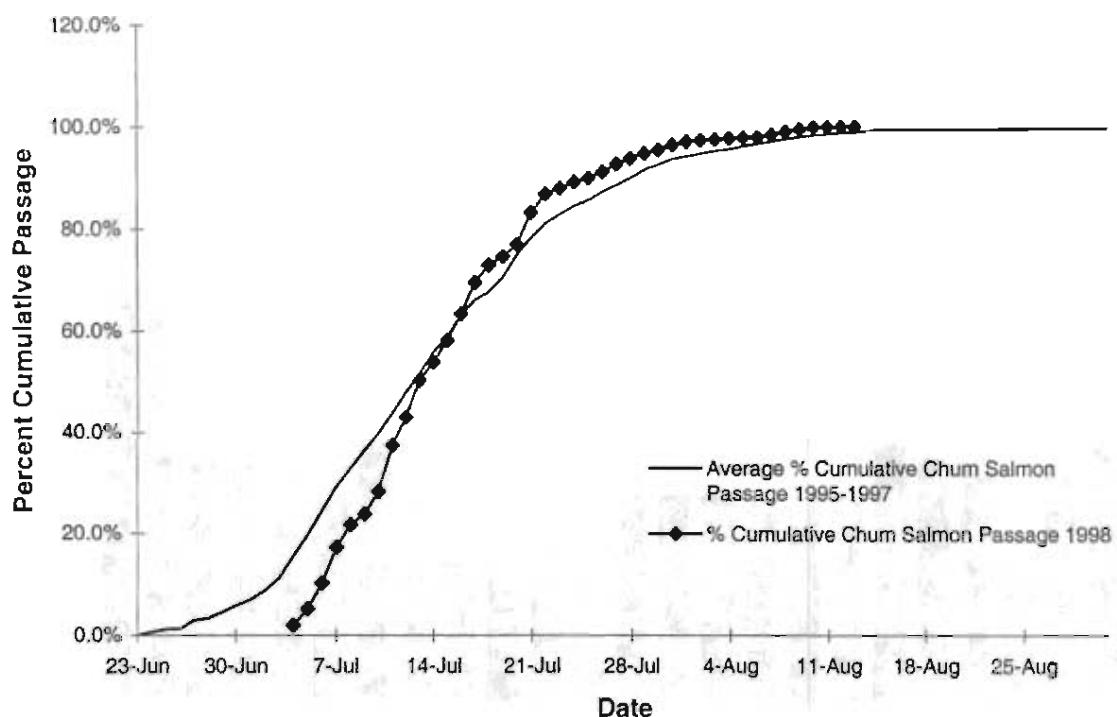


Figure 19. Pink salmon run-timing, Niukluk River counting tower, Norton Sound, 1995-1998.

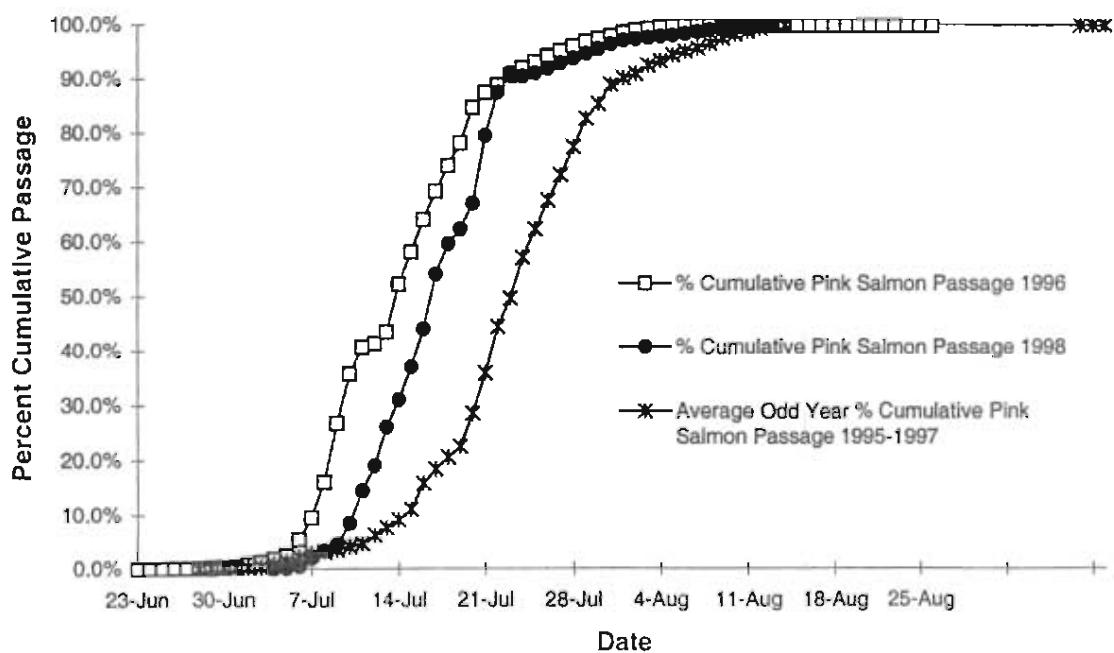


Figure 20. King salmon run-timing, Niukluk River counting tower, Norton Sound, 1995-1998.

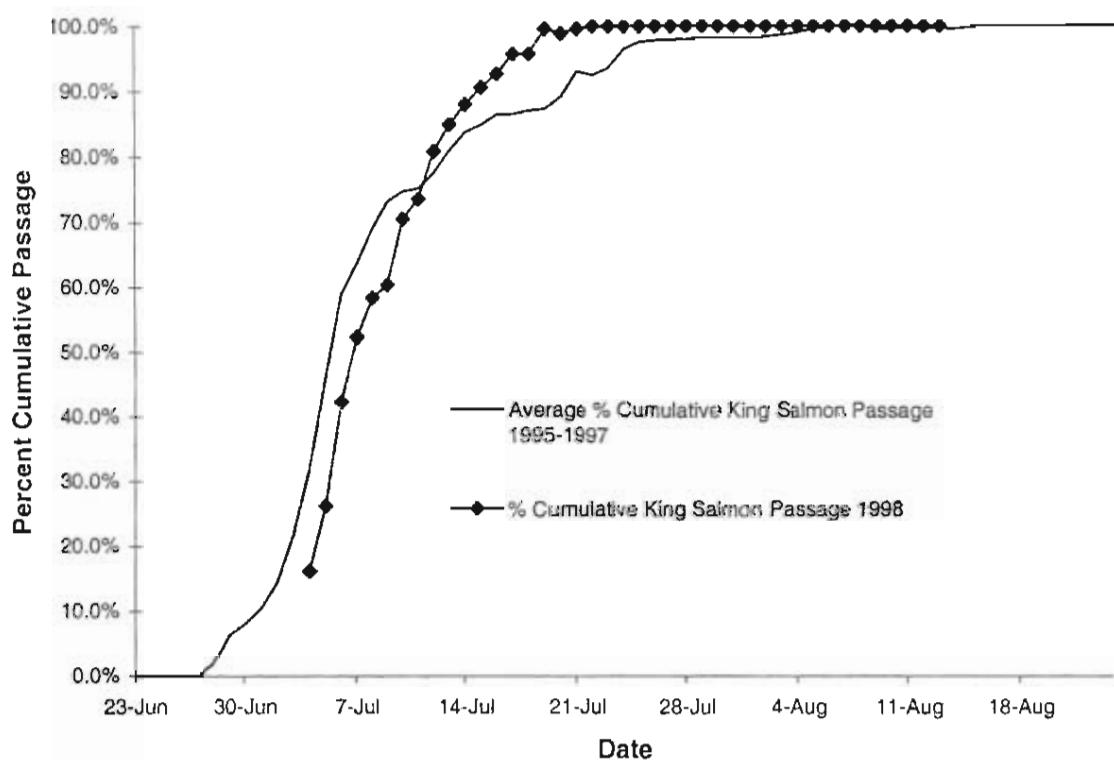


Figure 21. Coho salmon run-timing, Niukluk River counting tower, Norton Sound, 1995-1998.

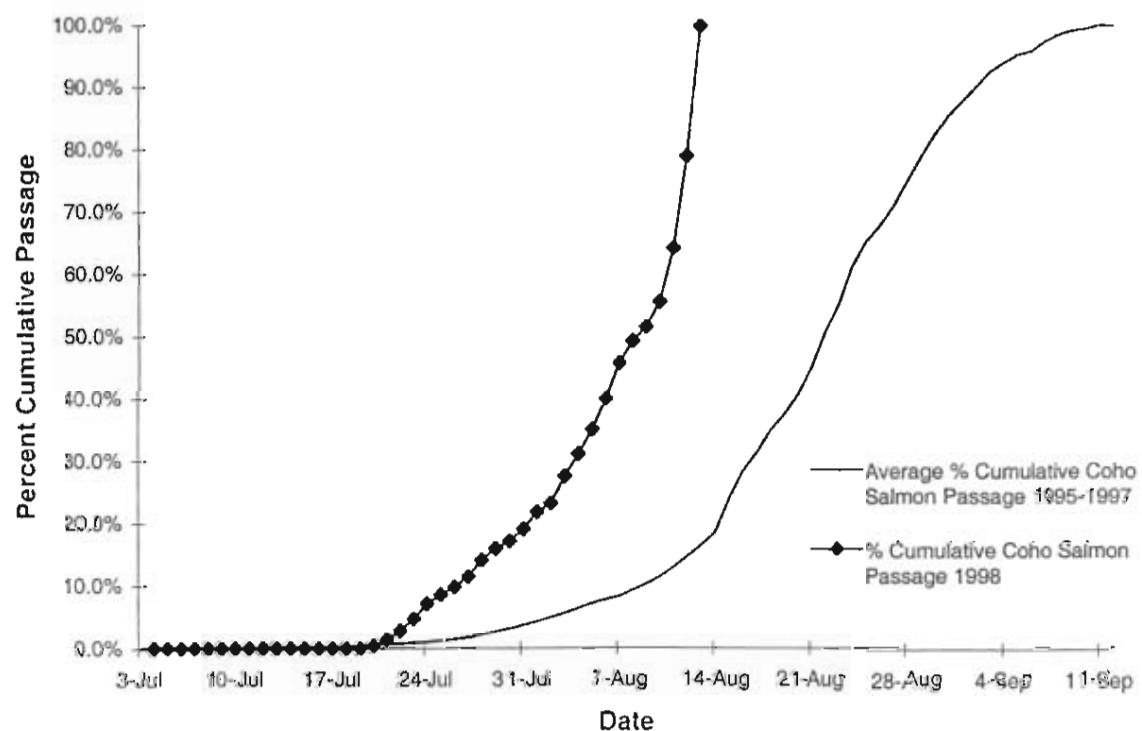


Figure 22. Dolly Varden run-timing, Niukluk River counting tower, Norton Sound, 1996-1998.

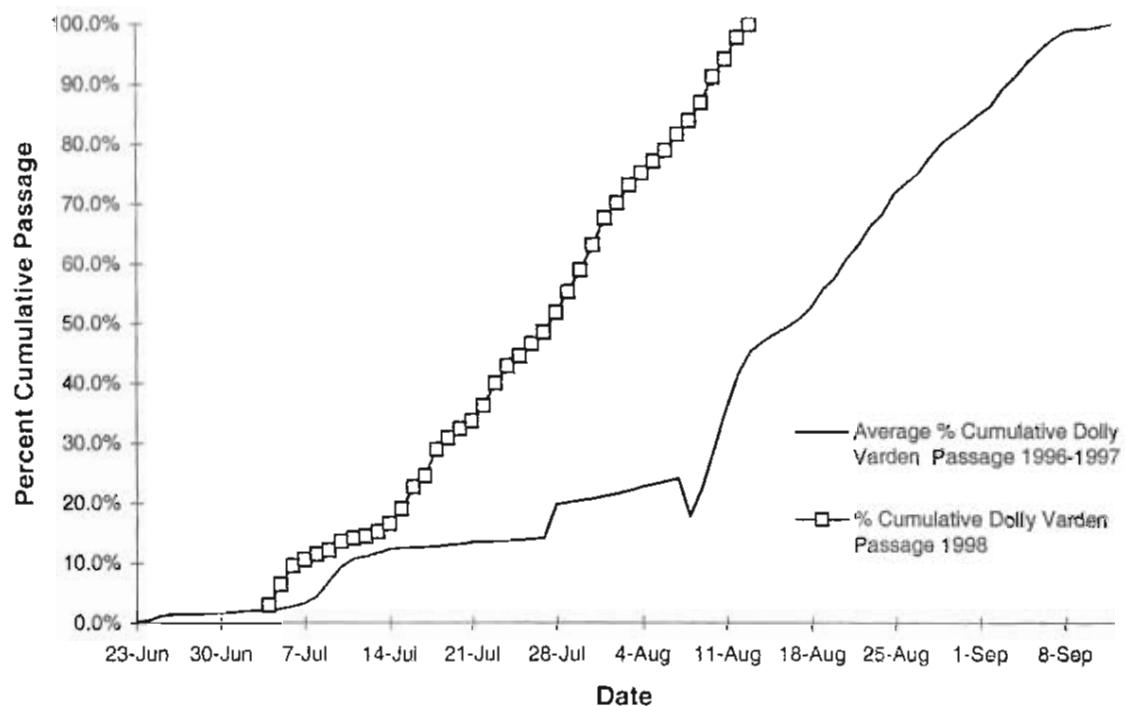


Figure 23. Cumulative chum salmon passage past the Niukluk River counting tower, Norton Sound, 1995-1998.

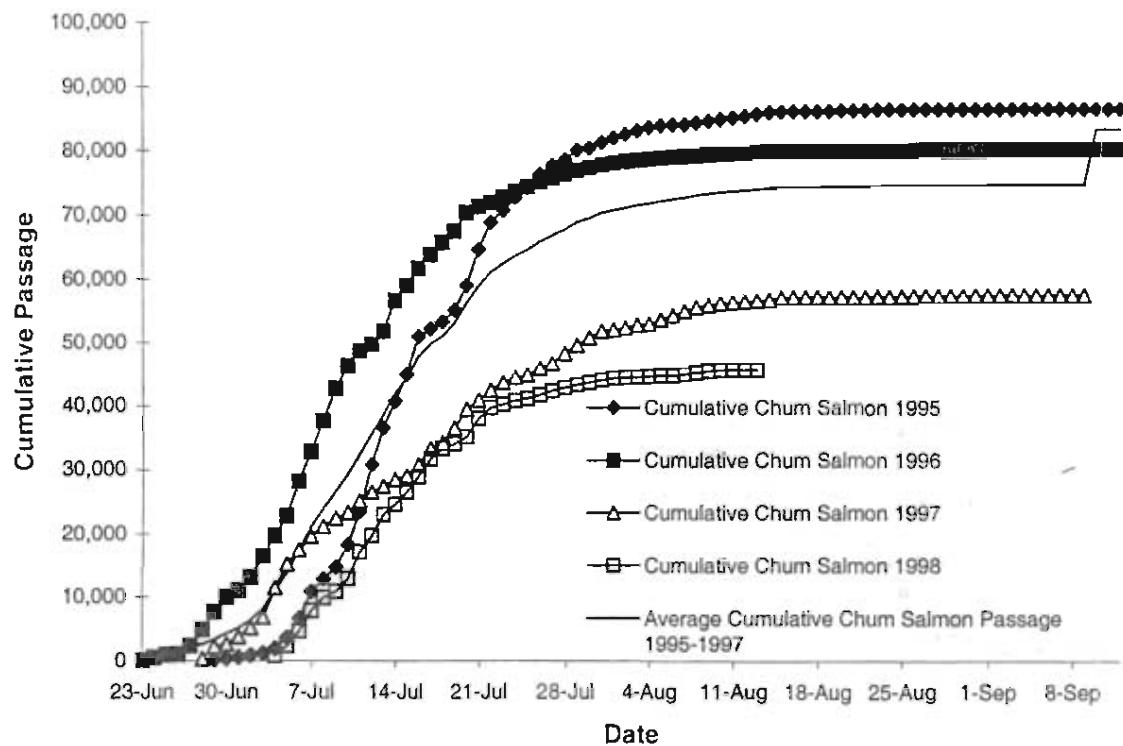


Figure 24. Even year cumulative pink salmon passage past the Niukluk River counting tower, Norton Sound, 1996-1998.

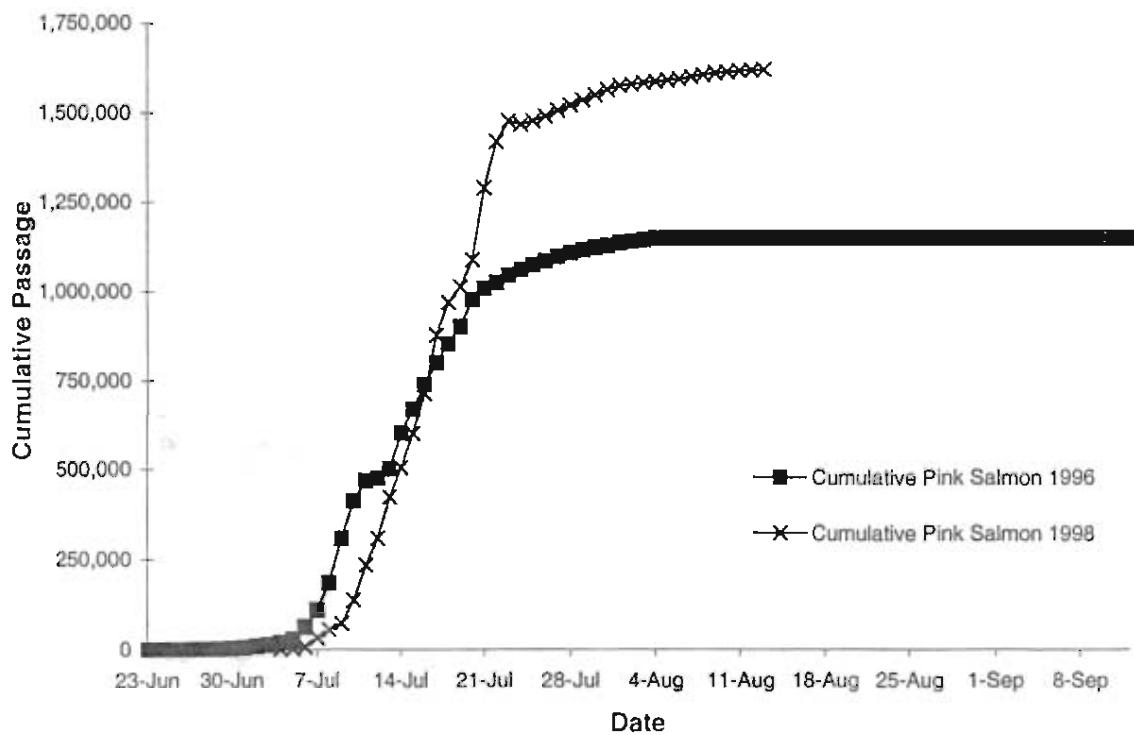


Figure 25. Cumulative king salmon passage past the Niukluk River counting tower, Norton Sound, 1995-1998.

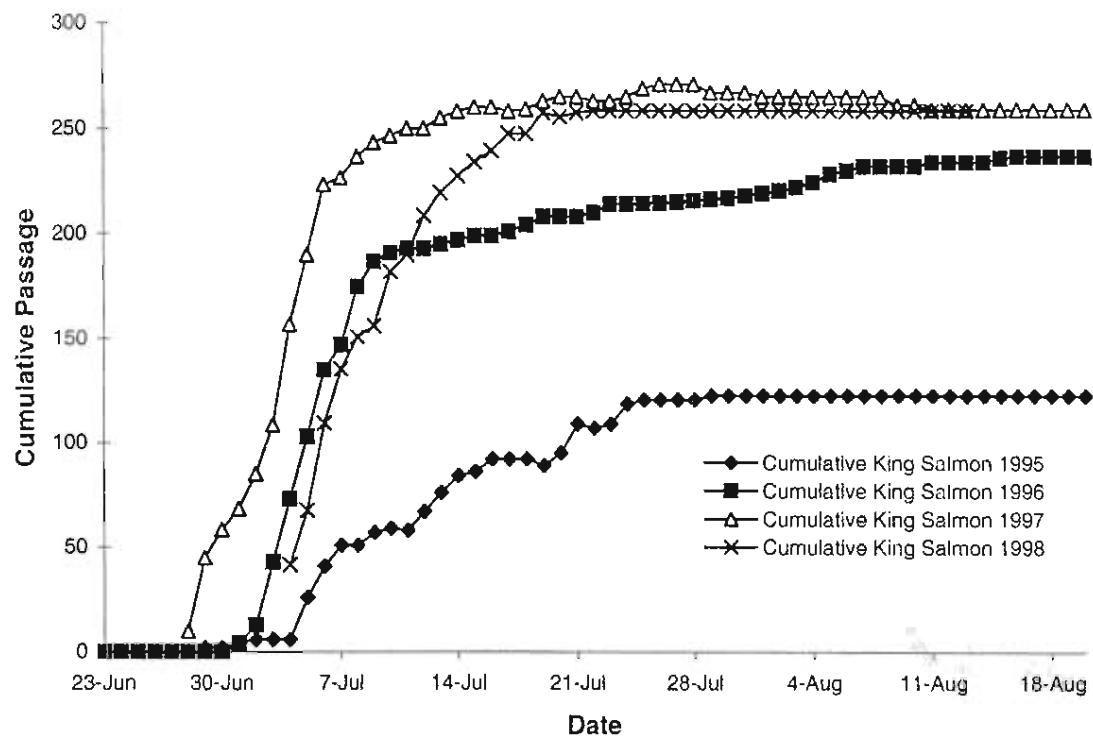


Figure 26. Cumulative coho salmon passage past the Niukluk River counting tower, Norton Sound, 1995-1998.

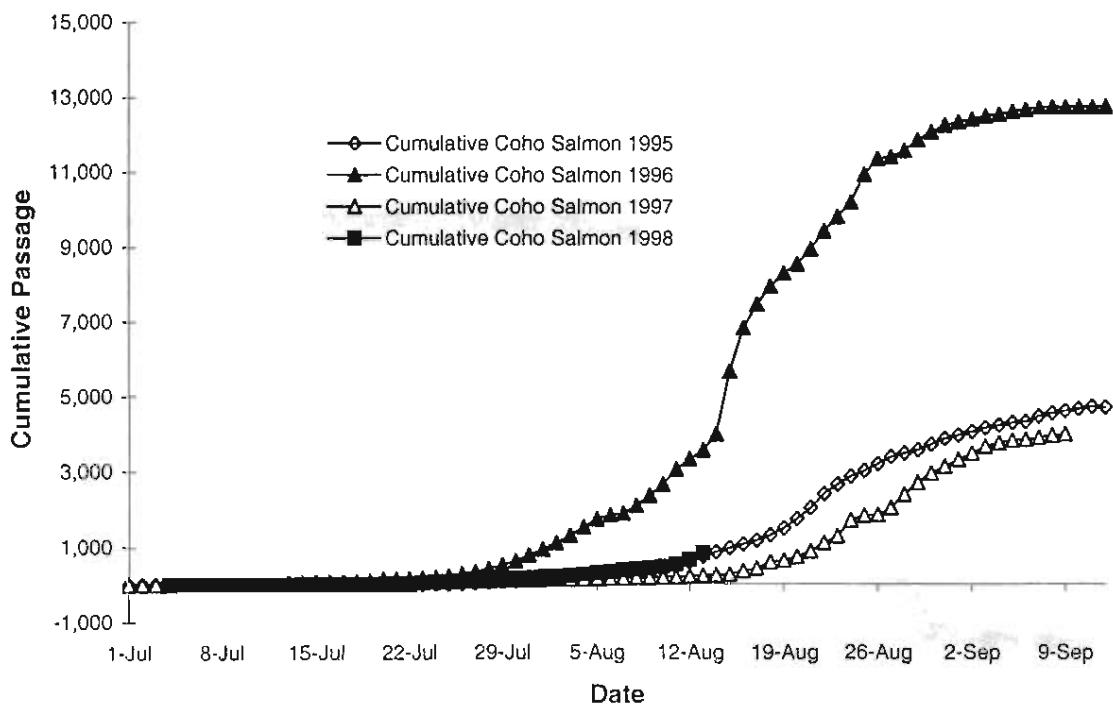


Figure 27. Cumulative Dolly Varden passage past the Niukluk River counting tower,
Norton Sound, 1995-1998.

